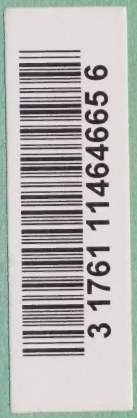
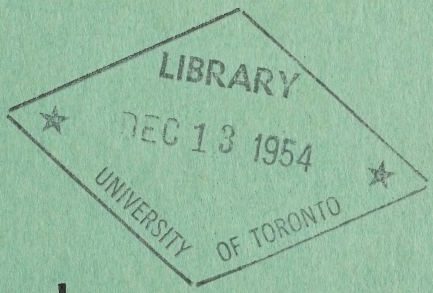
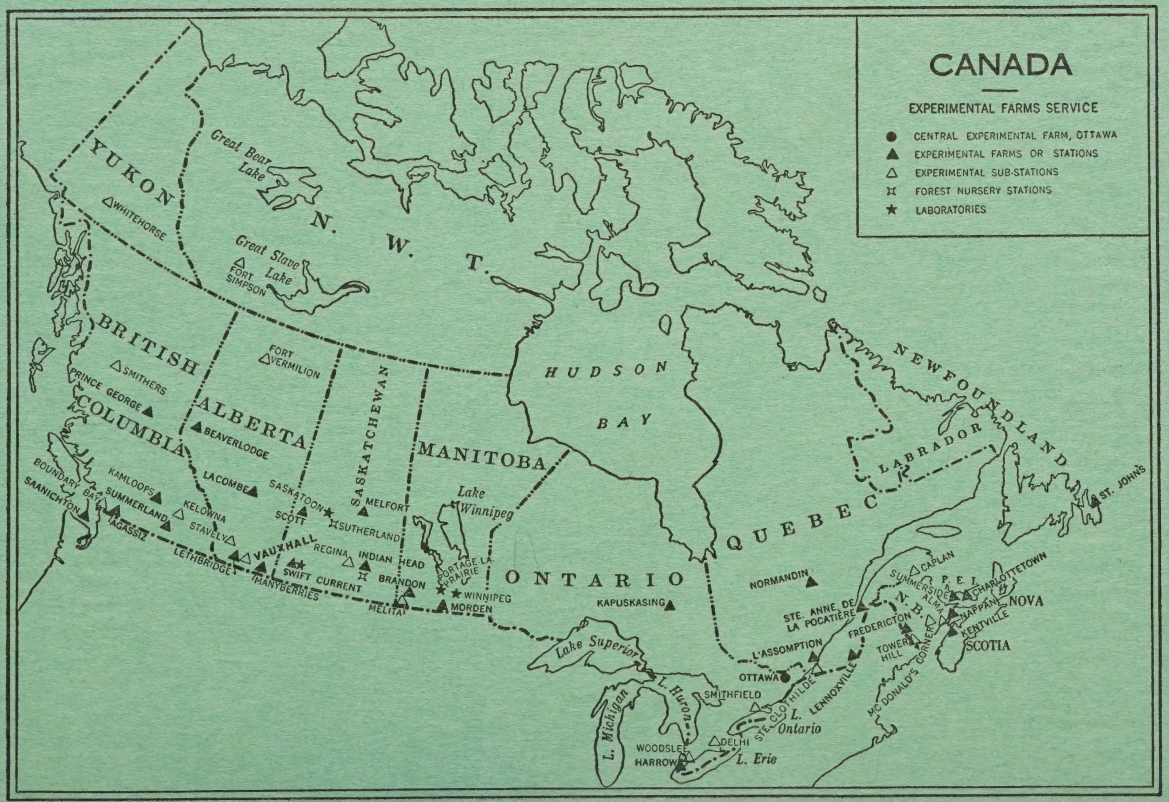
EXPERIMENTAL FARMS SERVICE





Canada
Department of Agriculture


CANADA
EXPERIMENTAL FARMS SERVICE
CENTRAL EXPERIMENTAL FARM, OTTAWA
EXPERIMENTAL FARMS OR STATIONS
EXPERIMENTAL SUB-STATIONS
FOREST NURSERY STATIONS
LABORATORIES
YUKON
WHITEHORSE
Great Bear Lake
N. W. T.
Great Slave Lake
FORT SIMPSON
BRITISH COLUMBIA
SMITHERS
PRINCE GEORGE
FORT VERMILION
ALBERTA
BEAVERLODGE
SASKATCHEWAN
MANITOBA
HUDSON BAY
Lake Winnipeg
NEWFOUNDLAND
LABRADOR
ST. JOHNS
QUEBEC
ONTARIO
BOUNDARY BAY
SAANICHTON
KAMLOOPS
SUMMERLAND
KELOWNA
STAVELY
JASPER
LETHBRIDGE
LACOMBE
SASKATOON
SCOTT
SUTHERLAND
MELFORT
VAUXHALL
REGINA
INDIAN HEAD
SWIFT CURRENT
BRANDON
MANYBERRIES
MELITA
PORTAGE LA PRAIRIE
WINNIPEG
MORDEN
KAPUSKASING
NORMANDIN
CAPLAN
SUMMERSIDE
P.E.I.
CHARLOTTETOWN
NAPPAN
NOVA SCOTIA
KENTVILLE
STE. ANNE DE LA POCATIERE
ALMA
FREDERICTON
N. B.
TOWER HILL
L'ASSOMPTION
OTTAWA
SMITHFIELD
STE. SOPHIE
LENNOXVILLE
McDONALD'S CORNER
L. Ontario
L. Michigan
L. Huron
L. Erie
Lake Superior
DELHI
WOODSLEE
HARROW

Experimental Farms Service

Canada Department of Agriculture

A System of Agricultural Experimental Stations to Investigate Agricultural Problems for the Benefit of the Farmer

Crossing block of hybrid corn at the Central Experimental Farm, Ottawa. Two male to six female rows, the female detasseled rows are dark.

Published by Authority of the
Right Hon. James G. Gardiner, Minister of Agriculture
Ottawa, 1954

90074—1

CONTENTS

INTRODUCTION

THIS booklet gives a brief statement of the organization and functions of the Experimental Farms Service of the Canada Department of Agriculture. It is not intended to be a guide-book or a report of accomplishments. A short account of the history of the Experimental Farms is given and then the present organization is outlined. A short statement indicates the program of experimental work being conducted at the Central Experimental Farm, Ottawa, and at the Branch Experimental Stations throughout Canada, designed to help in the solution of farmers' problems. In order to remind the reader of the wide variations in climate in the regions of Canada where agriculture is practiced, and to emphasize the great effect of these climatic conditions on crop growth, tables are included showing the weather data collected over long periods at Experimental Farms throughout the country.

Historical Outline

The establishment of a system of experimental farms in Canada developed from the recommendations of a select committee of the Canadian House of Commons appointed to study agricultural conditions in 1884. In 1886 "An Act respecting Experimental Farm Stations" was passed. Five locations were selected when the Experimental Farms were originally established. The Central Experimental Farm at Ottawa was designated as headquarters, with one branch farm at Nappan, Nova Scotia, to serve the Maritime Provinces; one at Brandon, Manitoba; one at Indian Head, in the then "Northwest Territories"; and one at Agassiz, British Columbia.

Dr. William Saunders became the first Director in 1886. Dr. J. H. Grisdale, who since 1901 had been agriculturist at the Central Experimental Farm, succeeded Dr. Saunders as Director in 1911. He became Deputy Minister of Agriculture in 1919. Dr. E. S. Archibald, who since 1912 had been Dominion Animal Husbandman at the Central Experimental Farm, succeeded Dr. Grisdale as Director in 1919. He was succeeded in 1951 by Dr. E. S. Hopkins, who since 1920 had been Dominion Field Husbandman at the Central Experimental Farm, and Associate Director of Experimental Farms since 1938.

90074—2

Organization of Experimental Work

The investigation of agricultural problems throughout Canada is in progress at the Central Experimental Farm, Ottawa, as well as at 28 Experimental Farms and Stations, 20 Experimental Substations, 10 Laboratories, and on 235 Illustration Stations. Different Stations, Substations and Laboratories are engaged in specialized work in various agricultural fields.

The administrative headquarters of the Experimental Farms Service is at the Central Experimental Farm, Ottawa, where investigations are conducted in nine divisions with specialized staffs. Agricultural problems proposed for investigation on the Branch Experimental Stations are discussed by the staffs on these stations with specialists at Ottawa. Investigational work is conducted at Ottawa and on the Branch Experimental Stations under the following divisions:—Animal Husbandry; Apiculture; Cereal Crops; Field Husbandry, Soils and Agricultural Engineering; Forage Crops; Horticulture; Illustration Stations; Poultry; Tobacco. Sections of this booklet show briefly under these headings some of the investigations, together with a few accomplishments, at Ottawa and on the Branch Experimental Farms.

ANIMAL HUSBANDRY

Balanced agriculture and a balanced, adequate diet for the Canadian people cannot be maintained without livestock production in the agricultural economy. At the same time, livestock production must be economically competitive if this balance is to be maintained. Thus, continued improvement must take place in the efficiency of livestock production to match the developments in other phases of production.

The Animal Husbandry Division has as its main purpose the study of problems of livestock production to the end that more products, of high quality, may be secured per unit of feed, labor, and money expended. This has led to studies of breeding for more efficient animals; of feeding for greater efficiency of use of feeds; and of management to reduce waste, losses from disease, housing costs, and labor requirements. In essence, this has meant a broad attack on the problems of livestock production and a correlation of livestock with other agricultural production so that a maximum return per acre of land might be obtained.

Work has ranged from the commonplace, such as comparing different rations for swine, to the unusual, such as attempting to develop a new breed of beef cattle by crossing bison and domestic cattle. Not all experiments have yielded information of equal value to the producer, and in general the direct benefits have come most rapidly from the simpler experiments which have produced knowledge with immediate practical application. However, many of the simpler problems have been solved, and a body of practical information has been developed. Continued progress in livestock production can come only from increasing attention to the more complex problems of nutrition, physiology, and animal breeding, and the animal husbandry program is being developed to expand this phase of work without neglecting the more practical problems that continue to confront the producer.

Pasture and Forage Studies

Despite the importance of grain production in the prairie regions, forage crops constitute the mainstay of agriculture in a large part of Canada. Because of this, emphasis has been given in recent years to studies on the more efficient use of forages in the form of pasture, hay, and silage. In Eastern Canada particularly, which is a grain importing area, studies have been directed at maximizing forage consumption and minimizing grain consumption for dairy cattle, beef cattle, and sheep production. Associated with this have been management practices, for livestock on pasture, that would produce maximum livestock products per acre.

90074—2½

At Ottawa, Ont., and Lennoxville, Que., studies are under way for the production of high quality beef with little or no grain. It has been shown that a combination of good pastures, high quality hay, and grass silage makes possible (1) the wintering of breeding stock without grain, (2) strong calf crops, (3) calves wintered with roughage and practically no grain, and (4) steers finished on grass without grain. Other studies have shown that grass silage can be used as the only feed for wintering beef cows, and that grass silage has a feeding value equivalent to corn silage for beef cows, milking cows, wintering beef calves, and wintering older steers, and that it can form a satisfactory feed for ewes. Investigations on the optimum amount of grass silage to use with hay for dairy cattle are under way at Ste. Anne de la Pocatiere, Que., and Charlottetown, P.E.I.

Hereford and Shorthorn steers. Studies are continually in progress to determine improved methods of beef production.

Pasture studies have been in progress for many years, especially in Eastern Canada, but new emphasis has been given to this work throughout Canada in recent years. The Melfort Station in Saskatchewan has been designated a special pasture station for Western Canada, and an extensive program is under way. Carrying capacity and productivity of irrigated pastures are being studied at Lethbridge, Alta., and Kamloops, B.C., and the improvement of carrying capacity by means of supplemental irrigation is being studied at Agassiz, B.C., and Ottawa, Ont. Productivity of various pasture mixtures is under study at Beaverlodge, Alta., and Charlottetown, P.E.I., and marsh

pastures are being studied at Nappan, N.S. Management practices to increase productivity of pastures in terms of milk production are being studied at Agassiz, B.C., and Ottawa, Ont. Pasture studies are conducted co-operatively with the Field Husbandry Division, and the Forage Crops Division.

Accurate measurement of the actual consumption by livestock on pasture has been and is a problem in all pasture work. At Ottawa, Ont., special studies are aimed at developing new techniques for measuring consumption and productivity. They involve among other things the use of inert markers and naturally occurring chromogens as indicators of consumption and digestibility. This phase of work is conducted in co-operation with the Chemistry Division, Science Service.

Breeding Investigations

Breeding for improvement of farm animals has been an art, but is progressively feeling the impact of science. Means of measuring performance and efficiency of feed utilization are supplementing and gradually replacing the eye of the judge. Procedures for determining, selecting, and combining the desired characters in the most efficient breeding system are being developed through experiments with swine, beef cattle, dairy cattle, and sheep.

Inbreeding in swine has been tested, and this system has been found to have certain disadvantages, but also some desirable features when applied properly. As yet it cannot be recommended as general practice. Linebreeding on the other hand, which has been tested more particularly with dairy cattle, does hold promise for the breeder. Selection of breeding animals, regardless of systems of breeding used, is the basic problem and the one to which particular attention has been given.

Crossbreeding, and the development of new lines or breeds, has been investigated with both sheep and swine. Some promising new lines of swine are being developed at Lacombe, Alta., and Ottawa, Ont. At Lacombe the line is based on Landrace $\times$ Chester $\times$ Berkshire, while at Ottawa the Landrace $\times$ Chester cross was used. These lines are being compared with the Yorkshire as pure lines, and tests are under way to determine their usefulness in crossing with the Yorkshires to take advantage of hybrid vigor in the production of market hogs.

Performance testing of beef cattle has been under investigation at Scott, Melfort, Indian Head, Sask., Lacombe, Alta., Brandon, Man., and Nappan, N.S. More recently a nutritional phase of this problem, that is, selection of the most desirable rations and systems of feeding for evaluating differences between animals and groups of progeny, is being investigated

at Lethbridge, Alta. A breeding project for testing the relationship between individual performance of beef bulls and the performance of the progeny has been undertaken at Kamloops, B.C., in co-operation with ranchers, purebred producers, and the University of British Columbia.

Crossbreeding work with different breeds of beef cattle, including the Brahman, is under way at Manyberries, Alta., and at this Station investigations are in progress to study factors related to winter hardiness or resistance to cold. Breed differences in foraging under severe climatic conditions, as well as the relationship of various climatic factors to winter gains, are under study.

Detailed comparative tests to determine the most desirable range sheep are being conducted co-operatively at Manyberries, Alta., and Swift Current, Sask., with the Wool Laboratory at the Experimental Station, Lethbridge, Alta., contributing to the study.

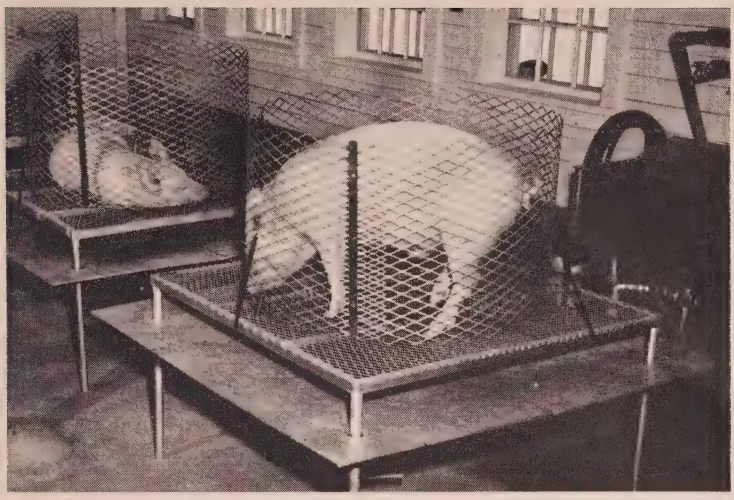
Crossbreeding projects for the determination of the most desirable crosses for market lamb production are carried out at Ste. Anne de la Pocatiere, Lennoxville and Normandin, Que., and Ottawa, Ont., while at Ottawa and Nappan, N.S., studies are being made of open-faced and close-faced types of Shropshire sheep.

A new venture in dairy cattle breeding at Ottawa, Ont., and Ste. Anne de la Pocatiere, Que., is the development of a polled strain of Ayrshire cattle.

Nutritional Studies

In the field of nutrition, reference already has been made to silage and forage crop work. At several stations emphasis is being placed on the effect of pregnant sow and baby pig nutrition in relation to death losses and efficiency of gain. The effect of different levels of alfalfa in the sow ration is being studied at Beaverlodge, Alta., while Stations at Melfort, Sask., Ottawa, Ont., and Nappan, N.S., as well as Beaverlodge, are concentrating on the problems of adequate nutrition of the baby pig. Time of weaning, creep feeding, artificial feeding of early weaned pigs, and the effect of antibiotics in young pig rations are under study. The effect of antibiotics on the growth rate of dairy calves also is being given attention at Ottawa and Lethbridge in conjunction with a study of rations to reduce milk consumption.

The feeding value of frozen and otherwise damaged grains, which occur from time to time in large quantities, is studied at Lethbridge, Lacombe and Beaverlodge, Alta., and at Scott, Sask., while the effect of different levels of alfalfa in the market hog rations is being studied at Lacombe. The protein requirements of pregnant ewes and the effect of sulphur derivatives on wool production are being investigated at Lethbridge.



Pigs, in special collection crates, for studies on digestibility of frozen and mouldy grains at the Experimental Station, Lethbridge, Alberta.

Management studies are being concentrated on such problems as loose vs. stanchion barns for milking cows (Lethbridge, Alta., and Agassiz, B.C.), the use of farrowing crates for pigs (Beaverlodge), pole barns for young dairy stock and beef cattle (Charlottetown, P.E.I., Nappan, N.S., Lennoxville, Que.), and the possibility of self feeding silage out of horizontal silos (Ottawa, Charlottetown, and Nappan). These projects are conducted in co-operation with the Agricultural Engineering section of the Field Husbandry Division.

Dairy processing research, mainly in co-operation with the Bacteriology Division of Science Service, has been concentrated on factors affecting cheese quality, but more recently emphasis is swinging to the effect of milk composition on processing and the processed product.

Problems of fur animal production are investigated at the Fur Farm at Summerside, P.E.I., where foxes and mink are maintained. In recent years emphasis has been placed on simplification of rations and the possibility of reducing the amount of fresh meat in the rations of these animals.

Attention to future possible agricultural development in the pioneer areas is given at such Substations as Whitehorse, Yukon Territory, where beef cattle are being observed under northern conditions; Fort Simpson in the Northwest Territories where a small swine herd has been established; Fort Vermilion in northern Alberta, where Shorthorn cattle and Yorkshire swine are maintained; and Smithers in west central British

Columbia, where a Shorthorn herd is established. These are smaller units where less extensive experimental work is under way, although observations are made on animal reactions and the place of livestock in the farm program for these areas. A more recent addition, following the entry of Newfoundland into Confederation, is the Station at St. John's, Nfld., where swine and dairy cattle are being investigated.

APICULTURE

The chief function of the Apiculture Division is to develop ways and means whereby beekeepers throughout Canada may obtain increased revenue from their bees. Improved methods of management for increased production; the preparation of honey for the liquid and recrystallized market; the development of more efficient and labor-saving processing equipment; and the control of bee diseases, are some of the principal fields of endeavor. Considerable work has been done to determine the best use of honeybees for the pollination of legume crops.

Experimental apiaries are maintained at the following Branch Experimental Farms: Regina, Sask.; Brandon, Man.; Kapuskasing, Ont.; Ste.-Anne de la Pocatiere, Que.; Kentville, N.S.; and Charlottetown, P.E.I. Their work consists largely of experiments on management of package and over-wintered colonies, wintering, control of American foulbrood with drugs, and recently in testing the performance of hybrid queen lines in co-operation with the United States Department of Agriculture and the Ontario Agricultural College, Guelph. In addition to the above, small demonstrational apiaries are operated at Scott and Indian Head, Sask.; Agassiz, B.C.; and Fredericton, N.B.

Liquid Honey

An inherent property of Canadian honey is its tendency to crystallize under natural conditions. Because of public demand for liquid honey some method of preventing or delaying crystallization is required, and of the many methods that have been investigated two show promise. In one method, honey in thin films is heated quickly to between 170 degrees F. and 190 degrees F. and cooled rapidly to 80 degrees F. or less. Samples so treated have remained crystal-free for more than a year in storage at 57 degrees F. The other method required that honey, after processing, be stored at less than 32 degrees F. until retailed. Such treatment not only prevents crystallization during storage but extends the crystal-free period when the honey is again held at ordinary temperatures. This treatment is not effective for honeys produced in areas where alfalfa is the predominant nectar-yielding crop.

Recrystallized Honey

High quality recrystallized honey must have a smooth, even set which will persist for many months. Recent tests have shown that when levulose exceeds dextrose by more than five per cent in a honey containing 80 per cent of these sugars, the moisture content must be less than 18 per cent to assure a

"shelf-life" of four months. In honeys where the proportions of these two sugars are more nearly even the recrystallized product will remain stable for the same period even if the moisture content is as high as 20 per cent.

Experiments with Honey Processing Equipment

The "batch" method of processing both liquid and recrystallized honey, used by commercial packers and beekeepers for years, has a number of disadvantages, namely, lack of flexibility for any given volume, lack of uniformity between batches and lack of continuity which resulted in numerous bottlenecks when any portion of the system was modified. Two types of heat exchangers, operating on a continuous-flow basis have been designed and tested.

1. A plate-type heat exchanger, currently employed by other food processors, was modified for use with honey, and high pressure plates are awaited to complete its adaptation to the industry.

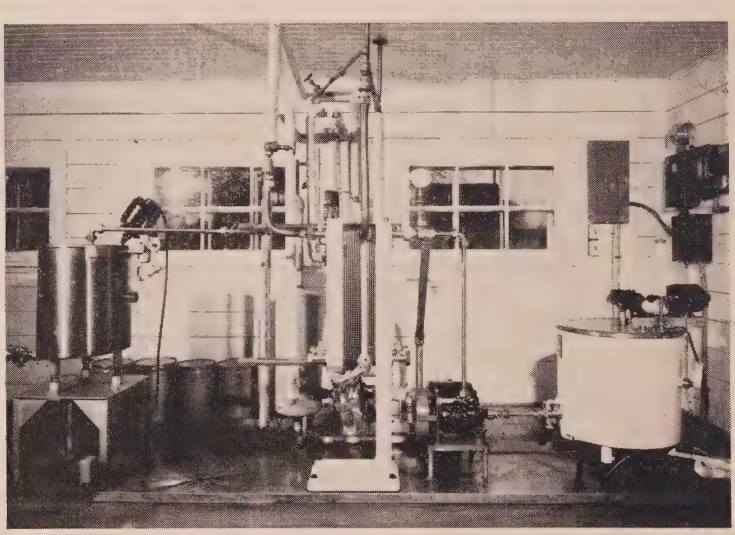


Plate-type honey processing unit developed at the Central Experimental Farm, showing (R-L) preheat tank, pump, heat exchanger, hot and cold water circulating units, and seed mixing tank with switch controls on the wall.

2. A tubular-type unit was constructed, in co-operation with the Agricultural Engineers of the Field Husbandry Division, and found satisfactory for heating the product to pasteurization temperature (165-180° F.) and cooling to 80° F. on a continuous-flow basis. The injection of seed in the line for recrystallized honey is receiving experimental trials.

Pollination

In co-operation with the Forage Crops Division, insect control, pollinator population, nectar volume and concentration, as well as seed yields in red clover are being thoroughly investigated. Honeybees have been shown to be efficient pollinators of second-bloom red clover in the Ottawa Valley. The honeybee population is fairly constant on the bloom to a distance of 300 to 400 yards from the hives. Beyond this range the number falls off sharply. Seed yields are closely correlated with honeybee activity in fields where injurious insects are not an important factor. Nectar samples taken directly from the flowers throughout the field show a fairly uniform volume at any one time.

Making nectar determinations on red clover for volume and concentration, to determine attractiveness to pollinators.

An extensive experiment to determine the effectiveness of honeybees in tripping and cross-pollinating alfalfa was conducted at Regina, Sask. The results show that honeybees trip alfalfa flowers in significant quantities when competition from other honey plants is at a minimum. Relatively high temperatures and low humidity are favorable to a higher rate of tripping by nectar-gathering honeybees.

Disease Control

Diseases of young and adult bees cause severe losses each year to Canadian beekeepers. In co-operation with the Bacteriology Division, Science Service, investigations are being

conducted on the use of sulpha drugs and antibiotics for the control of American foulbrood, European foulbrood, and Nosema. An antibiotic, fumagillin, has proved to be effective in reducing Nosema disease in adult bees. The sulpha drugs, as well as terramycin, inhibit the growth and development of the organism causing American foulbrood. Sodium sulphathiazole, sulphathiazole, and sulphadiazine, because of their greater stability, are extremely useful in preventing the spread of the disease.

Colony Management

The division of strong over-wintered colonies into two or three separate units, with the addition of a queen, is being demonstrated successfully at the Brandon Experimental Farm. A much greater production is secured from the divided colonies. This method is particularly adapted to conditions in the Prairie Provinces.

Several satisfactory types of winter packing materials have been tested at the Ste-Anne de la Pocatiere and the Brandon apiaries. The size of packages and most suitable time of arrival has been investigated at the Charlottetown apiary. In that province the two-pound package has consistently produced as much as the three-pound unit. The darker races of bees, Caucasian and Carniolan, are being tested at Kapuskasing to determine their suitability for the northern areas. A strain of honeybees with non-swarming tendencies is being tested at the Kentville apiary.

CEREAL CROPS

The principal function of the Cereal Crops Division is to make available for use on farms in all parts of Canada, the most profitable varieties of cereal grains, peas, field beans, flax and buckwheat. This involves an intensive system of breeding designed to create progressively better types. It also calls for the importation of new promising varieties from other sources.

All such varieties are subjected to intensive methods of comparative testing at widely scattered points. In this work the Experimental Farms and Stations, Illustration Stations and individual farmers participate. Lists of varieties found most suitable for different zones within each province are published annually in most provinces by a committee or board, composed of both Federal and Provincial officials.

The Cereal Crops Division also performs an important function in ensuring a continuous supply of Foundation Seed and Registered Seed of approved varieties for propagation primarily by members of the Canadian Seed Growers' Association.

The Division is organized as a plant breeding institution with headquarters at Ottawa, where the breeding of new varieties for Eastern Canada is chiefly centered. At the Laboratory of Cereal Breeding, Winnipeg, the work in the development of rust-resistant varieties of spring wheat, oats, and flax is centered. At the Experimental Station, Lethbridge, Alberta, development of spring wheats resistant to the wheat stem sawfly and hardier winter wheat varieties is the major problem. The Experimental Farm at Brandon specializes in the production of better barleys for Manitoba and eastern Saskatchewan.

In the appraisal of all wheat varieties produced by the Experimental Farms Service exacting quality tests are made. These are conducted mainly at divisional headquarters, Ottawa, where a well-equipped milling and baking laboratory is maintained.

In addition to the main projects, a number of research problems receive consideration. Among these are the problems connected with quality in wheat and barley and their products, inheritance studies of yield and quality in cereals, and the inheritance of resistance to plant diseases. To speed up the work new techniques have had to be developed. One of the latest is the use of growth chambers, where fluorescent lights and air conditioning equipment make it possible to grow four or five crops in a single year. The breeding of disease-resistant varieties is also advanced by the use of well-equipped plant pathology laboratories. A new cytogenetic section has been set up to work in close co-operation with cereal breeders. Both practical and fundamental genetic investigations are being

carried out and it is hoped that in this way some of the plant breeder's problems will be solved. Considerable time and attention is given to the development and improvement of machines and apparatus used in connection with the work of the division.

Interior of Cereal Crops Growth Chamber, at Central Experimental Farm, Ottawa, where four or five crops can be matured in one year.

Wheat

Since the inception of the Dominion Experimental Farms, thousands of different varieties of cereal grains, both of Canadian and foreign origin, have been carefully appraised. Many new varieties have thus been brought to the attention of the Canadian public. The most widely known of these undoubtedly is Marquis. The introduction of this variety was an outstanding event in Canadian agriculture since it transformed wheat growing in the Prairie Provinces from a relatively hazardous to a fairly safe enterprise. In more recent years, however, rust-resistant varieties have almost completely displaced Marquis in those parts of Western Canada where rust is a factor. These varieties are Renown, Regent and Redman, developed at the Laboratory of Cereal Breeding, Winnipeg; Apex produced at the University of Saskatchewan; and Thatcher from the University of Minnesota. It is estimated that from 1939 to the present time, the use of these five wheats in Manitoba and Saskatchewan has enabled Canada to produce 40-50 million more bushels of wheat per year than would have been possible if

disease-resistant wheats had not been grown. However these varieties do not have sufficient resistance to the new race of stem rust known as 15B and the Cereal Crops Division has developed new varieties with the necessary resistance, among them Selkirk distributed first in 1954.

In the drier portions of the Prairie Provinces west of the rust area the wheat stem sawfly is an important pest. Prior to 1947, serious economic losses caused by sawfly infestation were of general occurrence. With the development of the solid stemmed sawfly-resistant variety Rescue, at the Swift Current Station, and its release in 1947, these losses were greatly reduced. The project group on breeding spring wheats for the prairie regions centered at the Lethbridge Station, released a second sawfly-resistant variety, Chinook, in 1952. Chinook is similar to Rescue in sawfly resistance and superior to the latter in quality and drought resistance. Efforts are now being made to improve the yielding ability and disease resistance of the sawfly-resistant types.

In the northern parts of Alberta, where frost is a hazard, the early maturing, stem-rust-resistant variety Saunders, developed by the Cereal Crops Division, has displaced Red Bobs and Marquis and in 1952 occupied over 15 per cent of the wheat acreage in Alberta.

In Eastern Canada, two new spring wheats, Cascade and Acadia, developed at Ottawa have met with considerable approval.

Rideau, a winter wheat, developed from the cross Kharkov ×Dawson's Golden Chaff, distributed to the farmers of eastern Ontario in 1941, has continued to be popular in providing a new cash crop for the area. A new variety with resistance to the bunt commonly found in Ontario and with better grain quality than Rideau is expected to be ready for distribution in 1954.

Oats

Five new varieties of oats have been introduced since 1947. These varieties offer to oat growers added insurance against crop failure or low yields. They are as follows:—Abegweit, Lanark, Garry, Rodney and Scotian. While all of these varieties have been recommended for areas of restricted environmental conditions, some have been quite widely adapted.

Abegweit, developed at the Central Farm and originally recommended only in Prince Edward Island is adapted to many other areas in Canada extending as far from the place of origin as the Peace River.

Lanark, a high quality early maturing variety with good straw is limited in adaptability mainly to the eastern part of Ontario.

A new selection of Garry oats, which was developed at the Cereal Breeding Laboratory, Winnipeg, is resistant to Victoria blight and much higher yielding than the original strain of this variety. While somewhat less resistant to crown rust it has wider adaptability.

Rodney, also developed at the Cereal Breeding Laboratory, Winnipeg, was distributed in 1954. This variety is highly resistant to stem rust, covered and loose smut, and moderately resistant to crown rust. It has short, plump kernels and good straw. Preliminary tests have shown that both Garry and Rodney may be adaptable in certain parts of Canada outside the rust area of the West.

Scotian, selected from the same cross as Beaver (Vanguard $\times$ Erban) at the Central Farm is well adapted to conditions in Nova Scotia. Scotian was given its final testing and named by the Experimental Farm at Nappan, N.S.

An extensive oat breeding program is in progress at the Central Farm, Ottawa, and at the Cereal Breeding Laboratory at Winnipeg. Breeding work with this crop is also being carried on at a few Branch Stations with material often being supplied from Ottawa or Winnipeg for regional selection.

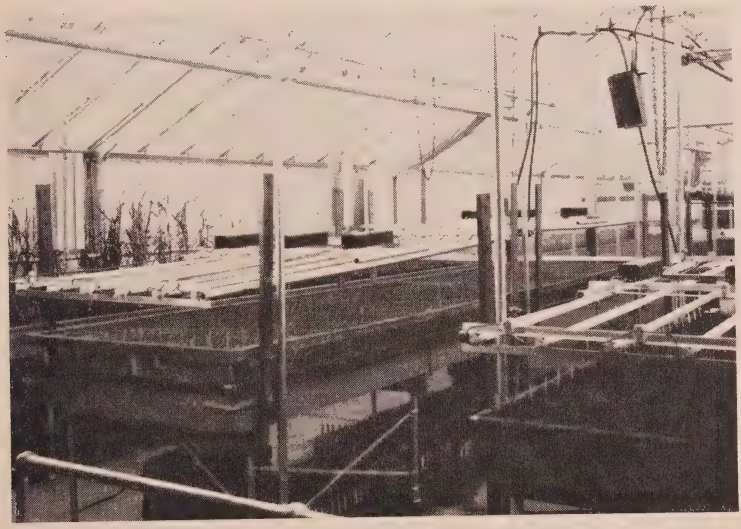
Barley

The barley acreage has increased rapidly during the past few years to a point where Canada now produces more barley than the United States. Favorable markets, the use of barley to compete with weeds, and the release of new varieties, have been largely responsible for the increase. The feed barley variety Vantage which was released by the Experimental Farm at Brandon, Manitoba, in 1947, has proved to be a very high yielder throughout the West. It is a recommended variety in the Prairie Provinces and for parts of British Columbia.

The Experimental Station at Lethbridge was responsible for the licensing of a new feed barley called Harlan in 1951. It was first introduced as a numbered selection from the U.S.D.A. It is a 6-rowed, rough awned variety which is especially suited for production on irrigated land in southern Alberta. It has also given good results on dry land. Two other varieties, Compana and Velvon II, both developed in the United States, have been licensed in Canada. Velvon II is grown in the dry areas of west central Saskatchewan. Compana is a 2-rowed variety which is grown on a large acreage in southern Alberta and Saskatchewan.

Another feed barley variety, Fort, was released by the Central Experimental Farm in 1952. It is adapted only to Eastern Canada but its outstanding resistance to lodging and ease of harvesting have made it a favorite with many farmers who find it to be a great improvement over varieties formerly available.

Selecting hybrids from large populations in the barley nursery at Ottawa.



Fluorescent lights help to speed up the growth of hybrids in the greenhouse.

90074—4

A variety of linseed flax selected at Ottawa and named Rocket was distributed in 1947. This variety is rather late in maturing but is recommended for the southern part of Manitoba and most districts in Saskatchewan. An early maturing variety called Rajah was selected at Ottawa and distributed in 1954.

The field bean variety Clipper was licensed in 1949. It is a little earlier in maturity than Michelite and Corvette, the varieties now in commercial production.

Buckwheat is mainly produced in Eastern Canada. Welsford, a variety of the rough hulled type, was licensed for distribution in 1947.

FIELD HUSBANDRY, SOILS AND AGRICULTURAL ENGINEERING

The Field Husbandry, Soils and Agricultural Engineering Division is responsible, as the name implies, for investigations in three broad fields of agricultural research. In these different phases of experimental work information is secured on the most efficient methods of producing cereals, hay, pasture, potatoes, corn, roots, fibre flax, and other field crops, under a variety of soil and climatic conditions. In the Field Husbandry section agricultural meteorology, crop rotations, weed control, and crop harvesting are studied. Under soil research, are included soil classification and survey, soil fertility, soil tillage, and soil erosion problems. Under Agricultural Engineering, design and operation of farm machinery are studied, particularly at Ottawa, Ont., and Swift Current, Sask., together with processing and storage of crops, farm building design and ventilation, drainage, and rural electrification. Irrigation is studied at Vauxhall, Alberta, and other locations.

Rotations

Rotation and crop sequence experiments have been conducted for many years throughout Canada. In Eastern Canada, crop rotation practices vary considerably from farm to farm, except where cash crops are grown. Where the main farm enterprise is comprised of cash crops and few livestock are kept, the importance of a proper crop rotation becomes particularly evident. For example, in that section of Ontario where cash crops are chiefly grown, the physical condition of the heavier textured soils has deteriorated. At the Experimental Substation, Woodslee, Ont., extensive rotation experiments on a clay loam soil are in progress. Experimental results show the advantage of including a sod crop such as alfalfa in the cash crop rotations. In the Prairie Provinces summerfallowing to conserve moisture is an important consideration in planning grain rotations. Attention also must be given to cropping for the control of wind erosion and weed eradication.

Weed Control

The introduction of 2,4-D in Canada in 1945 created in this country an unprecedented interest in weed control. This herbicide showed such promise that weed control projects involving its use have been conducted on 21 branch Experimental Farms.

The rapid acceptance of 2,4-D in Canada as a means of controlling weeds is mainly due to the results of the experiments conducted on these Experimental Farms. One of the

90074—4½

most spectacular findings in this connection was the discovery in 1945 that 2,4-D could be effectively applied in a very low volume of water (5 gallons or less per acre). When this low volume method of applying 2,4-D for weed control in grain was demonstrated on a field scale on the Experimental Farm at Indian Head, Saskatchewan, and on the Experimental Substation, Regina, Saskatchewan, in June 1946, there was started a wave of enthusiasm that spread across the Prairies, for weed control by the use of 2,4-D. In five years the use of low volume sprays in the field expanded from nothing, prior to 1945, to the spraying in 1950 of 13,500,000 acres with 2,4-D for weed control.

Control of weeds with herbicidal sprays has become popular in recent years.

A noteworthy characteristic of 2,4-D is that it controls most broad leaved weeds in narrow leaved crops. This means it is possible through its use to control weeds like mustard and thistles in wheat, oats and barley without serious injury to these crops.

The problem has remained of controlling broad leaved weeds in broad leaved crops. Some progress has been made in solving this problem and now a number of broad leaved weeds may be controlled in flax and even in grain seeded down to clover. This problem, however, is still far from solved. Many new herbicides and new approaches to this phase of weed control are being investigated. Pre-emergence weed control is a promising method which involves the application of the herbicide before weeds or crop emerge. A selective herbicidal film is thus placed at or near the surface of the soil through which many weed seedlings are incapable of emerging, although some crops are capable of passing through it uninjured.

A serious problem is to learn how to control economically and effectively narrow leaved weeds in narrow leaved crops, for example, the controlling of wild oats in cereal crops. To do so in wheat, oats and barley by the use of a selective herbicide seemed an impossibility until recently, but the results of experiments conducted for the past two years on the Central Experimental Farm at Ottawa indicate that it may be possible.

The discovery of 2,4-D has focused new interest on a very old problem. It has given hope of finding easier methods of weed control, and much has been accomplished in recent years in this regard.

Pasture and Range Studies

The economical improvement of pastures is the main object of a number of experiments in progress. These include studies of the use of fertilizer and lime to increase herbage production, of pasture management to maintain and secure uniform grazing, the value of supplemental irrigation and of various cultural treatments to improve the quality of the herbage. The production of annual pasture crops, to supplement the regular pastures in unfavorable seasons, is also studied.

Data collected over a considerable period show a wide variation in the productivity of different pasture areas under investigation. However, an increase in production at all locations, ranging from 40 to 85 per cent, has resulted from the fertilizer treatments. Furthermore, taking into account the cost of the fertilizer, this treatment has been profitable in nearly all cases.

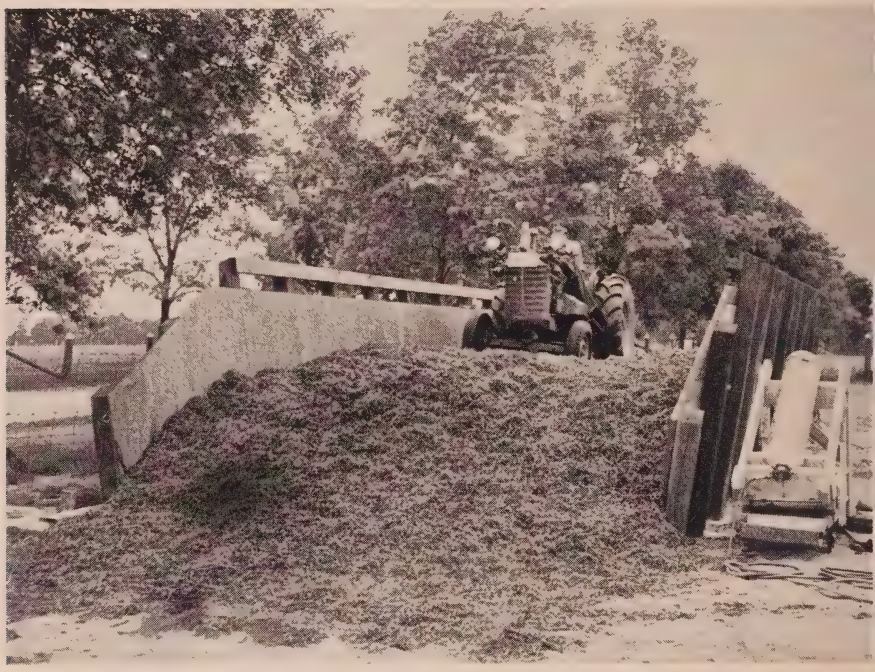
Investigations on rangeland in Western Canada have shown that moderate continuous grazing from date of range readiness at the start until the end of the season is preferable to rotational grazing. Supplementary spring pastures of early growing crested wheat grass are recommended for the prairies.

Silage Investigations

Since 1924 experiments relating to the harvesting and ensiling of forage crops as a livestock feed have been conducted at the Central Experimental Farm, Ottawa. In addition, experiments relating to silage making are conducted at several Branch Farms in Eastern Canada. The relationships between silage quality and type of crop or mixture, stage of maturity, moisture content, length of cut, degree of compaction, and use of conditioners, have been studied in both small experimental silos and large farm-scale silos.

Because of increased acreages of forage crops being used in recent years for silage purposes, as well as the high building costs of the vertical silo, studies have been initiated on the

possibility of ensiling such crops in other types of silos. The horizontal silo has been found to provide low-cost, efficient storage for silage crops. With its use forage crops can be harvested by a variety of farm equipment and may be ensiled either uncut or chopped.



Silage investigations have been an important line of research in the Field Husbandry Division since 1924. Here grass silage is being treated with sulphur dioxide gas.

Fibre Crops

The work conducted has been largely investigations in connection with the growing of flax and preparing the fibre and seed for market. Nevertheless experiments have been conducted also with many types of fibre plants in order to determine their suitability for Canadian conditions.

To determine where the best fibre flax can be grown, small areas of this crop are sown at Branch Farms located in the various provinces. The straw from these small plots is shipped to the flax mill at the Central Experimental Farm where it is de-seeded, retted and scutched and the quality of fibre determined. These tests were helpful in locating areas well adapted to the growing of flax during the period 1939-1943 when the

Canadian fibre industry expanded enormously on account of the war emergency. Plots are located on Branch Farms and in commercial districts where farmers may see for themselves the actual operations in progress. To study methods of retting and processing, experimental flax mills are located at the Central Experimental Farm, Ottawa, Ont., and at Portage la Prairie, Man.

Tests are carried on at Ottawa, with a view to securing fibre flax varieties that will under conditions in this country produce high yields of good quality and spinning value. Flax is sown on different types of soil to determine which type will produce the highest yield as well as the best strength and quality of fibre. Experiments are also conducted in order to determine the best stage, and methods, for harvesting flax under Canadian conditions. Various tests are in progress to ascertain the influence of fertilizers on the yield and quality of fibre and seed. Cost-of-production studies are made in order to determine what recommendations may be made to growers.

All new field or mill machines developed in other flax-growing countries are tested under Canadian conditions before being recommended. Considerable attention is devoted to the problem of control of weeds in fibre flax. The Pilot Flax Mill at Portage la Prairie studies possibilities of producing and retting fibre flax in the Prairie Provinces and the production of pedigree fibre flax seed. The utilization of fibre from linseed flax straw is also investigated at Portage la Prairie in the production of unholstery tow, and in the manufacture of cigarette, bank note, and linen bond papers.

Soil Surveys

Soil surveys are conducted in all provinces as co-operative projects with the Agricultural Colleges and Provincial Governments. The object of these surveys is to determine the nature, extent and location of the various types of soil in Canada and to classiy them on a systematic basis. This information on soils is valuable for many purposes, particularly where problems of land use are concerned. By the end of 1952, 183 million acres had been surveyed in a systematic reconnaissance manner and reports and maps covering 133 million acres had been published.

Soil Cultivation

In Eastern Canada fall plowing, particularly of clay soils, has shown some advantage over spring plowing. On the prairies surface tillage has almost completely replaced plowing. It has been amply demonstrated by the Experimental Farms that cultivation is required only to kill the weeds and to pre-

pare a seedbed, and that shallow cultivation is much cheaper and is equally as effective as deep cultivation . The maintenance of the vegetative residues on the surface of the soil is extremely important in order to prevent wind and water erosion.

Soil Moisture Investigations

Lack of moisture is the most important single limiting factor governing crop production in the Prairie Provinces. Since Angus Mackay, first Superintendent of the Experimental Farm at Indian Head, demonstrated the value of summerfallow to conserve soil moisture the Experimental Farms Service has continued to study this problem. It has been established that under prairie conditions only about one quarter of the precipitation which falls during the summerfallow period can be stored in the soil for use by the succeeding crop. Careful weed control on summerfallow is especially important since excessive weed growth will quickly deplete the moisture supply and nullify the beneficial effect of the summerfallow. Surface tillage which maintains vegetative residues on top of the soil is very important in dry land farming on the Prairies. In addition to preventing wind erosion this "trash cover" makes it easier for the rainfall to enter the soil. Also the trash greatly reduces the adverse effect of the impact of falling raindrops on bare soil and largely eliminates the puddling action of a heavy downpour. The trash cover also lessens runoff and water erosion as well as soil drifting. At the Soil Research Laboratory, Swift Current, Sask., these problems are under study.

Water Erosion of Soil

Study of the influence of intensity of rainfall and of various cropping practices on the extent of soil and water losses has been under way with special equipment at the Central Experimental Farm, Ottawa, since 1945. Results from these experiments have shown that the distribution and intensity of rainfall rather than total precipitation determine the degree of erosion. The growing of crops that provide good vegetative cover and protect sloping hillsides, has been found to be one of the most effective control measures. For instance, a plot in corn grown up and down a 10 per cent slope lost 189·56 tons per acre of soil from 1945 to 1952 inclusive, as compared with a loss of 3·86 tons per acre where the land was in oats and 0·91 tons per acre from a plot in timothy sod. The use of farm manure, suitable crop rotations, and such practices as contouring and strip-cropping, have been found effective in reducing soil and water losses.

Soil Fertility

The proper use of farmyard manure, commercial fertilizers and soil amendments has been investigated in experiments conducted for many years at Experimental Stations throughout Canada. More recently, as soil survey information has become available, fertilizer and liming tests have been conducted in co-operation with farmers on a number of the major soil types in the vicinity of the Experimental Stations. In this way it has been possible to obtain information relating to the varying conditions in Canada. Results from this work are a considerable aid in establishing suitable fertilizer practices for various crops throughout Canada. In addition to field tests, greenhouse studies have provided considerable information relating to the fertility and lime status of different soils. In co-operation with the Chemistry Division, Science Service, Ottawa, projects are in progress relating to soil phosphorus and potassium supply, phosphorus fixation, and the availability of these elements in relation to soil acidity or alkalinity. In addition, several chemical methods in use for diagnosing phosphorus and potassium supply in soils have been appraised in relation to crop response to these elements applied in fertilizers in greenhouse tests.

Mangels require a fertile soil. These mangels were grown in a rotation of mangels, oats, clover, and timothy. In 1953, their yield on the manured area was 20 tons per acre and on the untreated check only 4·70 tons.

Recently, since soil conditioners have been placed on the market as materials for improving the physical properties of soil, tests are being conducted at 18 Stations throughout Canada on these materials.

Agricultural Engineering

Experiments in agricultural engineering are conducted with various types of tillage, seeding, spraying, harvesting and processing equipment, to obtain information as to their relative efficiency, cost of operation and general requirements in farm operations. Investigations are conducted on methods of clearing land, equipment and structures for applying irrigation water, and on machinery utilization in water erosion control and land drainage. Information is also being obtained on livestock equipment, and barn ventilation, as well as on the design of farm buildings in order to reduce labor requirements in caring for livestock.

Special attention has been given to methods and machines for the harvesting of hay and silage. Extensive experiments have been conducted to secure data on the most suitable methods of harvesting forage crops and on labor requirements when using sweep rakes, forage crop harvesters, balers, self-unloading wagons, and other machines. These experiments have included studies on tower silos and on the development of a horizontal silo. Information is also being secured on self-feeders for silos and on the design of barns for the loose housing of livestock.

Low pressure sprayers have been developed for field and roadside spraying operations in weed control. In potato production operations data are being obtained on reducing potato injury. Studies of land drainage include experiments on methods of plowing, land leveling and shallow ditch construction for the removal of surface water.

In the Prairie region special attention at the Experimental Station, Swift Current, Sask., is given to machines for tillage and seedbed preparation, and harvesting operations. Experiments are also conducted on equipment for handling or conserving straw in relation to wind and water erosion control. Other investigations include spray irrigation equipment tests, utilization of combines and the construction of dykes and terraces for the conservation of soil moisture.

FORAGE CROPS

The activities of the Forage Crops Division at Ottawa, Ont., Saskatoon, Sask., and other centres, are directed primarily towards (1) developing and making available for use on Canadian farms high yielding, hardy, drought-resistant and disease-resistant varieties of grasses, clovers, alfalfa and other hay and pasture legumes, corn for silage and for grain production, soybeans, sunflowers and field root crops; (2) the study of hay, pasture and seed production problems; (3) the providing of foundation stocks of improved varieties.

Variety Tests

Extensive tests are carried out to determine the varieties of different forage crops which are best suited to the different agricultural zones as well as far northern conditions in Canada. These tests include old established varieties as well as the newer varieties and strains in order that reliable and truly comparable data may be available at all times for the guidance of the Canadian farmer.

Plant Breeding

An extensive program of grass breeding has as its object the development of hardy and superior strains for hay, pasture and turf purposes. Particular attention is paid to the improvement of timothy, brome grass, reed canary grass, orchard grass, meadow fescue, tall fescue and perennial rye grass with major emphasis being placed on disease resistance, hardiness and leafiness. For turf purposes considerable work is being done with creeping red fescue. During recent years improved varieties of grasses have been released for production on Canadian farms. Among these are Climax timothy, Hercules orchard grass, Ensign meadow fescue, Duraturf creeping red fescue and Summit crested wheat grass.

Hybridization between wheat and perennial grass (Agropyron) has been carried on with the object of developing a large-seeded, drought-resistant, perennial grass which would be valuable in the drier areas of Western Canada. While large-seeded, perennial strains have been developed, they have shown a lack of winter hardiness under prairie conditions. Efforts are now being made to develop hardier sorts.

Breeding work is also in progress with legume crops including alfalfa, red clover, ladino white clover, alsike clover and birdsfoot trefoil. A prime objective is the development of improved hay and pasture types of alfalfa having high forage and seed yielding potentials, resistance to disease, and ability to persist under grazing. Good progress is being made towards attaining those goals. In the case of red clover special attention is being given to the development of strains having greater winter hardiness and which are resistant to

the Sclerotinia root rot and northern anthracnose diseases. Greater hardiness is a major consideration in breeding of ladino white clover and an effort is being made to develop higher yielding strains of birdsfoot trefoil.

Harvesting and weighing of ears from experimental plots of hybrid corn.

The corn breeding program has to date resulted in the development of seven, early-maturing hybrids of superior yielding ability. These hybrids have been designated Canbred 130, Canbred 150, Canbred 210, Canbred 220, Canbred 230, Canbred 250 and Canbred 260. They have all been licensed and released to hybrid corn seed companies in Canada and are now in production on Canadian farms. The development of these early maturing hybrids has greatly extended the area in which field corn can be successfully grown as a grain crop in Canada; the 1953 acreage of grain corn was about 350,000 in Ontario. Seven later maturing hybrids suited for grain production in southwestern Ontario have also been developed, licensed and released for production. These include Harvic 222, Harvic 300, Harvic 333, Harvic 482, Harvic 485, Hesco 320 and Hesco 427.

The soybean breeding program has resulted in the development of a number of new, early and medium early varieties which have been licensed and are now in production on Canadian farms. These include:—Pagoda, Kabott, Acme, Comet, Mandarin (Ottawa), Capital, Hardome, Harosoy, Harley, Harmon and A.K. (Harrow).

Breeding work with field roots has resulted in the development of Acadia swede and Tip-top mangel both of which have been widely grown by Canadian farmers. More recently

efforts have been directed towards the development of swedes resistant to the clubroot disease. Good progress has been made in this work and it is expected that one or more new varieties will be released in the near future.

Hay and Pasture

The testing of various species, varieties and strains of grasses and legumes for their productivity, nutritive value, aggressiveness, persistence, and adaptability for hay and pasture in the various agricultural areas of Canada, is an important phase of an extensive hay and pasture program.

Data collected for a number of years at Ottawa, Ont., Lennoxville, Que., and Ste. Anne de la Pocatiere, Que., show that the addition of alfalfa in hay-pasture mixtures has given an average increase of 20 to 30 per cent over mixtures without this legume. Furthermore, it has been found that the practice of taking a hay crop for one or two years prior to grazing alfalfa mixtures results in increased yields. The increase in production from hay plus pasture, as compared with continuous pasture, amounted to from 31 to 47 per cent. Newly developed creeping rooted alfalfas show promise for use in combination with grass for pasture in the drier prairie areas, and help to bind the soil. It has been found also that it is unnecessary to add the so-called "bottom" species to the tall-growing grasses and legumes used in short-term rotations. The addition of such species including blue grasses, red fescue, red top, and wild white clover is warranted only if the field is used for continuous pasture, where no hay crops are taken or for long-term pastures in areas where those species do not come in naturally.

Annual and supplementary hay and pastures have been compared under various conditions. For this purpose new varieties of oats, millet, and Sudan grass alone or in various combinations are under continuous test. Roxton oats have proved to be the most productive variety for pasture purposes. Piper and Tift Sudan grass have shown considerable promise over ordinary commercial seed of Sudan grass.

Seed Research, Production and Distribution

Considerable time and effort is devoted to the study of methods of producing forage crops seeds. Research is being conducted in co-operation with other divisions on pollination, particularly by honeybees, and injurious insect control in relation to legume seed production areas, as well as on fertilization and harvesting methods in relation to both grasses and legumes. This program has given information of considerable value to the seed growers.

Foundation seed block of Climax timothy. Production of foundation stock seed is an important function of the Experimental Farms Service.

Foundation stock seed of the varieties developed by the division, is multiplied and distributed to suitable growers through the Canadian Seed Growers Association. In this way pure seed stocks of different grass and legume varieties, soybeans, corn, sunflowers, millet and field roots are utilized to produce pedigree seed, which in turn is multiplied in volume and flows into commercial seed channels.

Other Research Activities

An essential part of the crop improvement program is the collection and evaluating under Canadian conditions of forage plants from all parts of the world. Several thousand introduced species and varieties are annually included in these tests at Ottawa and on Branch Stations in different parts of Canada.

Cytological studies are carried out as a practical aid to plant breeding and have played an important role in the plant breeding program. The use of the chemical substance, colchicine, and other means of inducing changes in the inheritance of plant characters has led into a field of special research which has aided greatly in the development of improved varieties and has opened up a whole new field of possibilities for the plant breeder.

Rapid methods of nitrogen determination have enabled the plant breeder to select for higher protein content, and plant nutritional studies conducted in the greenhouse have made it possible to recognize malnutrition symptoms under field conditions.

HORTICULTURE

The Horticulture Division is responsible for investigations concerning fruits, vegetables and ornamental plants. The work is conducted at almost all Branch Stations, although at many it is largely variety testing and minor cultural experiments. In the Experimental Farms Service horticultural research and experimental work is carried on mainly at the following locations: Kentville, N.S.; Fredericton, N.B.; Central Experimental Farm, Ottawa, Ont.; Morden, Man.; Summerland, B.C.; Saanichton, B.C.; the Substation for muck soils at Ste. Clothilde, Que.; the Substation for horticultural crops at Smithfield, Ont.; and to a lesser extent at Harrow, Ont., Lethbridge, Alta., and Agassiz, B.C.

Tree Fruits

Fruit breeding has been one of the main activities of this division since its inception. At Ottawa, the breeding of tree and small fruits adapted to the relatively severe conditions of eastern Ontario and Quebec has constituted a major effort. The apple has received first attention because of its importance as a commercial crop. Several varieties originated by this division are now commercially grown not only in these areas but in other parts of the country. Among these, the best known are Melba, Joyce, Lobo, Atlas, Hume, Lawfam and Sandow. The Spartan variety, originated at the Experimental Station at Summerland, B.C., has received considerable attention from the growers of the Okanagan Valley. An effort is being made by this division to originate a hardy variety earlier than Melba and a hardy late winter apple. Bancroft appears to be a real possibility as a winter apple and is being tested on a widespread commercial scale. Several of the more promising very early varieties have been released under numbers for final evaluation. With the increasing difficulty in controlling apple scab by spraying, emphasis is now being placed on the development of varieties resistant to this disease.

A comprehensive breeding project with tree fruits is now under way in an attempt to produce higher quality fruit from hardier varieties better suited to the severe conditions of the Prairie Provinces and more northerly areas. This is a co-operative project among various Branch Stations and other institutions on the prairies, with breeding work centred at the Experimental Station, Morden, Man.

In plum breeding research attention has been paid largely to hybrids between native plums. As a result of this work one outstanding plum, Grenville, a hybrid between *Prunus nigra*

and *P. salicina,* has been introduced, and another outstanding plum hybrid, resulting from a cross between *P. salicina* and *P. besseyi,* has also been adopted.

Hybridization between various species of cherries has resulted in the accumulation of much interesting material which is being studied from the standpoint of induced "polyploidy" to overcome sterility resulting from interspecies hybridization. The variety Van, introduced by the Experimental Station at Summerland, B.C., appears to have some resistance to cracking.

Breeding research with peaches and apricots is being conducted at two western Branch Stations and a few new varieties have already been introduced. The best known of these are the peaches Spotlight and Solo, originated at Summerland, and the Scout apricot introduced by the Experimental Station at Morden, Man.

Pears have never been an important crop in eastern Ontario and Quebec but the origination at Ottawa by this division of several varieties of good quality and outstanding hardiness is having the effect of increasing the production of this fruit. In the present pear breeding program, the development of varieties resistant to fireblight is a major objective.

Small Fruits

Raspberry breeding has resulted in the introduction of several varieties of outstanding hardiness and excellent performance. The better known are Trent (early), Madawaska, Muskoka and Ottawa. Several more have been recently released under number for final evaluation. Among the main objectives of this work is the production of varieties resistant to cane blight and anthracnose.

The division has introduced three outstanding late strawberry varieties: Louise, Elgin and Tupper. The present breeding program has as one of its objectives resistance to leaf spot and scorch. The Saanichton Station is working toward development of resistance to the red stele disease.

Thornless gooseberries originated by this division are now generally available, and of these Captivator is the best known commercially.

With black currants the major objective of the breeding work over a number of years has been the production of varieties resistant to white pine blister rust. Of the varieties introduced, Consort seems the most outstanding.

Rootstocks and Tree Building

One of the important problems facing the apple industry in Eastern Canada and British Columbia is the heavy loss of trees from collar rot, winter injury to roots, bark splitting, and

crotch injury. A thorough study is being made of the hardiness of various seedling and vegetative rootstocks and their resistance to collar rot. A comprehensive study of various hardy varieties as frameworks is being conducted at Ottawa, Kentville, Fredericton, Morden and Summerland. One outstanding hardy rootstock and framework builder, originated and released under the name Robusta No. 5, propagates readily from stools and has been found resistant to fireblight and collar rot and is extremely hardy. Similar work with peach trees is being carried on at the Experimental Station at Harrow, Ont.

Apple orchard, Central Experimental Farm, Ottawa. By improving varieties and tree-building techniques, apple growing areas are being extended.

Vegetable Crops

The testing, breeding and selection of vegetable varieties to suit various conditions throughout Canada has been a main effort for many years and work along these lines is in progress at Ottawa and almost all Branch Farms and Stations. Many vegetable varieties and strains have been introduced and some have been widely adopted over extensive areas. Dorinny, an early table corn variety introduced by this division, is the best known among these corn varieties. A table corn, Sugar Prince, originated by the Morden Station, is a good quality early hybrid. Several earlier tomato varieties have been introduced, such as, Carleton by Ottawa; a hybrid tomato,

Monarch, by the Station at Morden, Man.; and Earlinorth by the Station at Lethbridge, Alta. Extensive tomato breeding programs are being carried on at Ottawa, at Lethbridge, and by a number of prairie stations co-operating with the Experimental Station at Morden, Man. Other noteworthy vegetable introductions are the Selkirk, Director and Alton peas originated at Ottawa and the Tiny Tim pea produced by the Morden Station. A strain of onions known as Yellow Globe Danvers No. 11 and the Delcrow cucumber have found wide application in certain districts. Considerable interest is being shown in the cabbage variety Canadian Acre, a small-headed variety introduced at Ottawa. Breeding for disease resistance is an important phase of the vegetable investigations, particularly with tomatoes, garden peas and beans.

Celery (upper) and lettuce plots on the Ste. Clothilde Substation in the muckland area of southwestern Quebec where these are important crops.

A comprehensive potato breeding program, with high quality of tubers and disease resistance the main objectives, is in progress with headquarters at the Fredericton Experimental Station where all breeding work is done. Promising seedlings from this project are tested by Branch Stations and other co-operating institutions across Canada under the National Potato Variety and Seedling Testing Project. The

headquarters of this testing project are at Ottawa. It includes as well the testing of all new varieties and seedlings originated both in Canada and in other countries. Two promising blight-resistant varieties originated at Fredericton, namely, Canso and Keswick, have been introduced to the trade.

Another important phase of the work with vegetables is the maintenance of a large number of foundation stocks of various vegetables for use by the vegetable seed industry. Some work is also proceeding with the problem of weed control by various chemicals. At the substations of Whitehorse, Yukon Territory, and Fort Simpson, N.W.T., tests are conducted of species adaptability and variety performance under northern conditions.

Ornamental Horticulture

A large part of the work of this phase of horticultural activities is the testing and introduction of new plant materials for the improvement of home grounds. In recent years much of this has been done by the western Branch Experimental Stations where many worthwhile trees and shrubs have been developed and distributed to farmers over a wide area. Prinsepia, cotoneasters and hybrid lilacs are notable examples. Much of this work has been done by the Experimental Station at Morden. A very large program of tree distribution for windbreak or shelterbelt purposes operates from the Forest Nursery Stations at Indian Head and Sutherland, Sask., with millions of seedlings being distributed annually.

Breeding work with ornamentals has largely been confined to lilacs, roses, ornamental crabapples and lilies. In addition to the late blooming group of lilac varieties known as *Syringa* × *Prestoniae,* newer and distinct lilac hybrids have been produced. Many hardy bush-type roses have been originated and distributed from Ottawa and Morden where several varieties well suited to the extreme prairie conditions have been produced. The series of rosybloom crabapples introduced in the early thirties has gained great popularity; the varieties Cowichan and Makamic being of outstanding ornamental value. The "stenographer" series of lily varieties introduced some years ago has won international recognition. The second and third generations have produced some outstanding varieties, such as Hurricane, Spitfire and Lysander. A recently named variety "Addington" won the Griffith Cup as the best seedling of non-longiflorum type exhibited at the New York show of the North American Lily Society. Recent introductions from Morden are the Morden Pink variety of Lythrum, and a perennial aster named Sunup, both suitable for prairie gardens.

The major investigations in floriculture at Ottawa, begun in 1948, are cultural experiments with carnations, roses, poinsettias, snapdragons, chrysanthemums, asters and gladioli. Fundamental work on flower bud differentiation of chrysanthemums is being carried on, as well as investigation of other problems in the production of greenhouse crops for the florist trade. At Saanichton, problems dealing with bulb production, as well as the forcing of flowering bulbs under artificial illumination, are being studied.

Macoun Memorial Garden, Central Experimental Farm, Ottawa. Named in honour of the first Dominion Horticulturist.

Plant Nutrition

In the field of plant nutrition considerable expansion of research work has taken place in recent years. The relationships between plant tissue analysis and yield, which in turn form the basis for optimum fertilizer recommendations, have become a major field of investigation at Ottawa, and already some recommendations have been made to growers on this basis. Orchard management trials are in progress at Ottawa, Ont., Kentville, N.S., and Summerland, B.C. At Saanichton considerable experimental work is being conducted in the use of mulches, especially sawdust, in the production of various crops including some of the flowering bulbs.

For some years the Experimental Station at Summerland, B.C., has been studying problems associated with the irrigation of tree fruits, and at the present time it is possible to recommend schedules and equipment to the growers in the semi-arid areas of southern British Columbia. The use of irrigation in bulb production is under investigation at Saanichton, B.C., and experimental work has begun at the Kentville Station on the growing of vegetable crops under irrigation of some of the sandy soils in that area.

Problems arising with canning crops are being studied at the Substation at Smithfield, Ont., where a large crop rotation trial is in progress, the main objective of which is the maintenance of soil organic matter. A comprehensive crop rotation investigation with strawberries as the main cash crop is under way at the McDonald's Corner Substation of the Experimental Station at Fredericton, N.B. The nutritional and fertilizer requirements of crops grown on muck soils are the main activities of the Substation at Ste. Clothilde, Que.

Low Temperature Research

Low temperature laboratories are operated at Kentville, Ottawa, Smithfield, Summerland and Morden. At these centres research in temperature and varietal relationships is conducted on a fairly large scale. A considerable part of the program deals with the effect of nutrition and maturity upon the storage life of fruit, particularly the apple. The utilization of controlled atmospheres for the storage of apples and pears has resulted in definite recommendations for commercial application, largely in the Annapolis Valley. Considerable investigation of the application of mechanical refrigeration in storage warehouses has been carried on in British Columbia by the Summerland Station from the standpoint of equipment capacity, air duct design, and air distribution. Among other phases of these investigations are studies of maturity in relation to storage life, the development of a reliable index of maturity, and the causes and elimination of various storage disorders.

Fruit and Vegetable Processing

Laboratories concerned with the processing of fruits and vegetables are operated at Kentville, N.S.; Ottawa, Ont.; Morden, Man.; Lethbridge, Alta. and Summerland, B.C. These laboratories are largely concerned with various aspects of fruit and vegetable preservation, both as canned products and in the frozen state. This work involves the development and testing of methods as well as the testing of great numbers of varieties for adaptability to the various processes.

The Kentville laboratory has developed equipment and a method for the dehydration of fruits and vegetables now used by a number of large commercial plants. A table syrup has been produced successfully from apple juice using an "ion exchange" system for the removal of acid and metallic impurities. The principle of ion exchange has also been used to develop a method for the determination of total pectin, which appears to be as accurate as the more unwieldy methods now used.

A major part of the work at Ottawa has dealt with the commercial application of freezing to the preservation of strawberries, raspberries, peas, green beans, corn on the cob, asparagus, spinach and other crops. The Ottawa laboratory has also perfected a simple method of fruit juice preservation that allows the bottling and holding of cider and other fruit juices for prolonged periods. A method of producing chip potatoes of superior color and quality has been devised. Frozen fruit desserts have also been successfully prepared.

A satisfactory method for the production of pectin from sunflower heads has been developed by the Morden laboratory. Some work has also been done in developing methods for the preparation of crabapple jelly and sorghum syrup. This laboratory is co-operating in the development of a canning industry in the Morden area of southern Manitoba.

The laboratory at Lethbridge, established in 1951, is mainly concerned with problems of fruit and vegetable processing in the irrigated areas of southern Saskatchewan and Alberta. Several projects are under way, including the effect of hard water on processed vegetables, maturity problems, processing qualities of vegetable varieties, and a study of the nutritive quality of vegetables grown in these areas.

Many aspects of the processing industry have been under investigation at the laboratory at Summerland, B.C., and much has been accomplished. Methods and new equipment have been devised and recommended to the industry for the candying and glacéing of fruit, particularly sweet cherries. A method has been developed for the production of opalescent apple juice, with avoidance of discoloration due to oxidation. Investigations have shown that the quality and uniformity of solid-pack canned apples are improved by the use of calcium chloride or other calcium compounds, which makes possible the canning of softer varieties, such as Wealthy and McIntosh. Other lines of investigation include tomato canning processes, jam and pickle manufacture and problems arising in peach canning.

POULTRY

The poultry industry in Canada has undergone great development during the past fifty years. As a result the demands of the industry upon the services provided by the Poultry Division have increased proportionately. The Poultry Division, in attempting to provide this service effectively, has found itself increasingly involved in research calculated to provide the information needed. It must not be overlooked that in many areas of Canada the provision of information on general matters of poultry husbandry is still the greatest need and the Poultry Division at the Branch Stations in such districts is responsible for demonstrating good poultry farming practices and the dissemination of currently available information and advice to poultrymen and farmers who require it.

Demonstration and the provision of information are not the only contributions of such branch Stations, although this is generally so on the small stations and substations in remote or newly settled areas. At Branch Stations in the older agricultural districts, where there are sufficient facilities, poultry research of two types is conducted. A prime necessity is to supply information on problems of largely local significance, and secondly to provide information of general application either through individual research projects of the Branch Stations or co-operatively with other Branch Stations or with the Central Experimental Farm at Ottawa. By having a number of widely scattered Stations working in the same research program the effects of differences in climate, in housing, and in individual management, can be measured, and the applicability of the findings under general conditions can be more precisely determined.

Organization of the Poultry Division

Research is the principal responsibility of the Division together with the necessity to see that information from this research is made available to poultrymen through the proper channels. Research of more basic nature is largely conducted at Ottawa where personnel with specialized training, and laboratory and other facilities are available. In a few instances where professional poultry specialists are available this type of work is also conducted on Branch Stations. A somewhat larger number of Branch Stations which have better facilities than average and a relatively large housing capacity for birds, are used as testing stations in co-operative projects directed from the Central Experimental Farm, and in some instances conduct specific research projects as well. Still another group of Stations provides a demonstration of sound poultry practices

and furthers the poultry interests of their districts through cost studies and investigation of management factors, particularly those of local concern.

The research of the Poultry Division is discussed in this booklet under the headings of genetics, nutrition and management.

Genetics (Poultry Breeding)

A large proportion of the research of the Division is in poultry breeding. Methods for the more efficient selection of breeding chickens and for the development of new strains of egg-producing fowl are being studied intensively at several stations. In order to expect even a reasonable degree of success along such lines, large numbers of birds are essential and a large investment in buildings and feed is necessary. It is also advantageous to have experimental birds carried not only in large numbers but under a number of different environmental conditions of climate and management. For this reason, the co-operation of the Branch Stations has always been important in the breeding research with poultry that is conducted by the Experimental Farms Service. Breeding research is being undertaken with chickens, turkeys and geese.

Fowl: Eggs furnish approximately 60 per cent of the revenue derived from poultry. The inheritance of the ability to produce eggs is very complex and great difficulty is experienced in devising selection procedures that will give good results when the egg production of the flock has already been improved to relatively high level. As a result, the major breeding project of the Poultry Division is designed to investigate the most effective means of increasing egg production. In addition to the Central Experimental Farm, five Branch Stations having the greatest bird housing capacity are involved in this project. These five Stations contribute to the project not only the possibility of providing the very necessary large population of birds, but also a measure of the effect of a great variety of climatic and management factors, which information is of great value. The five Branch Stations are located at Charlottetown, P.E.I., Harrow, Ont., Morden, Man., Lethbridge, Alta., and Agassiz, B.C.

In this project the breeding populations are located at Ottawa, where geneticists supervise the breeding work. Several strains of egg production fowl are being used in this study. All chicks are shipped by air at hatching time to the co-operating Stations where the various strains are intermingled, reared to maturity and carried through a year's laying in the same way. In this manner all strains tested at each Station have the same environmental treatment, and differences between them could, therefore, be expected to be true genetic differences. At

the same time a large population of daughters from each sire and dam is available for progeny and sib testing of sires. Another important feature of this project is the ability to determine from the results how important are the differences between the same strain at the different locations. That is to say, how much effect differing environments have on performance and whether different strains react in the same way or differently to different environments.

Breeding pens used in the genetics research program of the Poultry Division at Ottawa.

Other Branch Stations such as Indian Head, Saanichton and Kentville are working on different aspects of this complex problem of how to improve commercial egg-production strains of fowl.

The selling of chicken over the counter in the eviscerated and cut-up form in recent years has stimulated production of poultry meat. Several Branch Stations as well as Ottawa are studying methods of breeding meat production fowl. Strains of birds are being selected to meet the demand for a meat-type chicken and problems have been experienced similar to those usually met by the breeder of meat-type birds, such as low fertility, low egg production and low carcass quality. These problems are being investigated from many aspects. The problem of low fertility in White Wyandottes is being studied at

Lacombe. At Ottawa a breed of meat birds has been originated for the purpose of top-crossing to produce well muscled, broad breasted birds which also make economical gains. Other broiler strains are being compared at Ottawa and at co-operating Branch Stations. An extensive test of the crossing ability of meat strains is under way at Fredericton while the Station at Ste. Anne de la Pocatiere is investigating the selection of a broader breasted strain of Barred Rocks.

Turkeys: Methods for breeding a commercially satisfactory young turkey broiler-roaster are being investigated at the Central Experimental Farm.

Geese: With the rise in popularity in Canada of the goose as a meat bird, a study has recently been initiated at Ottawa to determine a satisfactory breeding program for increasing the reproductive ability and growth rate of geese.

Nutrition

Research in poultry nutrition in the Experimental Farms System is conducted at Ottawa and at three or four Branch Farms where special laboratory facilities, pen and battery accommodation and trained personnel are located. At present, the Stations at Nappan, N.S., Brandon, Man. and Swift Current, Sask., are equipped for this work. Recently the Station at Melfort, Sask., has undertaken special work in poultry nutrition. Investigations being conducted are concerned with a wide variety of subjects, including rations for broilers, laying hens, turkeys and growing and breeding geese.

Broilers: Broiler raising is a relatively new development in the poultry industry in Canada. It is a highly specialized and competitive business, and great emphasis is laid on the production of as much meat on as little feed and in as short a time as possible. At Ottawa, work has been conducted on the use of Canadian grown grains, chiefly wheat, to provide high energy rations.

At Ottawa, Brandon and Melfort, the values of various antibiotics, arsenic compounds and other growth stimulants are being studied and compared. These materials increase the rate of growth of broilers and thereby shorten the time necessary to bring the birds to market weight and decrease the amount of feed required.

Recently, the price of fats and grease from packing houses and rendering plants has dropped to a low level. Hence studies are being conducted at Ottawa to determine the value of these materials as a source of energy in broiler rations. Similar work is being done at Nappan, N.S., but the fat being used there is a by-product of the manufacture of cod liver oil. At some

Stations, products of local origin such as lobster meal, kelp meal, sunflower seed oilmeal and fish waste are being tested in broiler rations.

Laying Rations: Various methods of feeding laying hens have been studied and the values of sources of protein supplements are being tested. At the present time, the effects of different levels of energy and protein in laying mashes are under investigation.

Turkeys: The feeding of turkeys is studied to a limited extent at Ottawa, but a specialized research unit for turkey nutrition is located at Swift Current, Sask. Among the problems which are being investigated are methods of decreasing the cost of range rearing, the toxicity of certain insecticides which might be encountered on range and the use of rape seed oilmeal in fattening and finishing turkeys. Vitamin requirements and interrelationships and antibiotics in turkey feeds are also being studied.

Geese: Research is being conducted on the nutritional requirements of goslings and the feeding of breeding geese at Ottawa. Experiments with geese being raised on pasture are also part of this program. The breeding geese are now being fed a pelleted diet exclusively because of the applicability of this method. The protein level required for optimum growth in young goslings has been determined.

Management

At all of the Stations, improved poultry management practices are constantly being tested. New poultry equipment and labor-saving devices and practices are being utilized wherever feasible.

The value of different types of houses, with and without supplementary heat is being determined under cold weather conditions at Kapuskasing. Various types of brooding and laying houses are in use at the different Stations including a roun house at Charlottetown and two-storey houses at several Stations. This permits the assessment of the advantages and disadvantages of different types of houses and different types of ventilation systems for these houses.

TOBACCO

A comprehensive experimental program is conducted by the Tobacco Division with respect to the five main types of tobacco grown in Canada, namely, flue-cured, burley, dark, cigar, and pipe tobaccos. It includes investigations on seedling production, soil tillage, soil properties, fertilizers and nutrition, crop rotations, sucker control, harvesting methods, curing, breeding, varietal testing, tobacco physiology, and disease and insect control. The four branch Experimental Stations associated with the Tobacco Division in this program are strategically located in the principal commercial tobacco-growing areas in Canada—Harrow and Delhi in Ontario, and L'Assomption and Lavaltrie in Quebec.

Tobacco growing in Canada has undergone considerable change since the Tobacco Division was formed in 1906. Forty years ago, production was largely restricted to burley in Ontario and to pipe and cigar leaf in Quebec. During the past twenty-five years, consumer taste has shifted from cigar and pipe smoking to cigarettes, which has greatly changed the requirements of production and now bright flue-cured cigarette tobacco is the principal type grown. In 1953, approximately 94 per cent of the Canadian tobacco crop was of this type.

Canada's progressive independence of the foreign tobacco producer as well as the expansion of her export markets provides outstanding evidence of success in the improvement of yield and quality through the application of improved methods and the use of varieties developed largely by research. Leaf tobacco imports declined from 20 million pounds in 1920 to 1·68 million pounds in 1952, 60 per cent of which was cigar leaf. Tobacco exports have risen from practically nil to about 38·5 million pounds in 1952. The proportion of domestic tobacco used by Canadian manufacturers has increased greatly. For example, the content of Canadian tobacco in cigarettes rose from 30 per cent in 1927 to 99 per cent by 1944. The quality of Canadian flue-cured leaf compares favorably with that produced in other countries.

Breeding and Varietal Testing

The production of new varieties by hybridization and selection is a major function of the division. The Experimental Station at Harrow, Ont., has produced the burley varieties Harrow Velvet and Briarvet, both resistant to black root rot, and Haronova which is highly resistant to black root rot and moderately resistant to brown root rot. Over 80 per cent of the burley tobacco grown in southwestern Ontario in recent years is of these three varieties.

The new flue-cured variety Delcrest, developed at the Harrow Station and the Delhi Substation, has been widely accepted by Canadian growers for its resistance to black root rot and its superior quality. The small, aromatic pipe variety L'Assomption Havane grown in Quebec was produced at Ottawa.

Field tests are conducted to determine comparative merits and to maintain types desired and approved by the tobacco trade. Several imported varieties have been tested and introduced to the growers. These include the flue-cured varieties Hicks and Jamaica Wrapper and the cigar leaf variety Resistant Havana 211.

Tobacco Soils and Fertilizers

Specific soil types from the various tobacco-growing districts have been analysed and classified and, on the basis of these studies, advice is given to established or prospective growers. Mineral element deficiencies in the soil, methods of soil conservation, and the maintenance of soil organic matter by crop rotations and cover crops, have been investigated.

Extensive experiments on tobacco fertilizers, including the balance of nutrients (nitrogen, phosphorus, and potassium) and sources of materials for the different types of tobacco, have been conducted. Based on the results of these experiments, fertilizer recommendations for the five types of tobacco grown are drawn up annually and submitted to fertilizer manufacturers and tobacco growers. Also, tests are conducted on the effects of calcium, sulphur, manganese, boron, copper, and chlorine.

A recent development in fertilization practice is the application of fertilizer in bands of a few inches from the row of tobacco. Tests show that the acre value of flue-cured tobacco is increased significantly by this newer method as compared with the older method of drilling the fertilizer in the row before transplanting. Also, recent tests have demonstrated a favorable response of burley tobacco to split applications of fertilizer, in which half of the fertilizer is applied at transplanting time and half three weeks later.

At the Delhi Substation it has been shown that rye straw, disked when ripe, can be substituted for manure in growing flue-cured tobacco. Crop rotations have been evolved which provide for the maintenance of soil productivity and the control of soil-borne diseases. A common rotation developed for flue-cured tobacco is fall rye, alternating with tobacco every two years.

Chemical Control of Suckers

Since the manual removal of sucker growth from the tobacco crop is time-consuming and costly, methods of using

chemicals to suppress sucker growth are being developed. Mineral oil applied to the stub of the stalk, and maleic hydrazide sprayed on the top leaves after topping the plants, are two methods that seem to offer promise for the control of sucker growth. Tests with these substances have resulted in greatly reduced sucker growth on flue-cured, burley and cigar tobaccos, and in some instances have increased yields.

Irrigation

Experiments have shown that irrigation by sprinkler system can be used to advantage on the flue-cured tobacco crop during periods of drought, particularly during the latter part of the growing season when a liberal supply of soil moisture is required to promote growth. Findings from field experiments are that irrigation, employed judiciously, increases the yield and improves the quality of the crop. Studies are in progress of the best time to irrigate and how much water to apply in relation to the soil characteristics and daily weather records.

Irrigation of flue-cured tobacco at St. Thomas de Joliette, Que.

Physiological and Laboratory Investigations

Physiological and laboratory studies are an important part of the Divisional program, directed towards identification and measurement of the chemical and physical characteristics that constitute tobacco quality. These studies also include the changes occurring in leaf constituents as influenced by various fertilizers, and such cultural practices as seedbed management, time and height of topping, and suckering. The progressive development of some of the organic leaf substances through the stages of maturity, curing, and fermentation is studied. The importance of sugars in the cured leaf of flue-cured tobacco has been revealed. During the flue-curing process, the transformation of starch to sugar, and fixation of the bright yellow color

when the sugar content is high, results in high-quality leaf. New strains and varieties of tobacco are tested for quality in the laboratories.

The physiological aspects of the mineral nutrition of tobacco are studied in the greenhouse where the plants are supplied with nutrient solutions of pure chemicals. This method of growing tobacco plants provides precise control over the nutrient supply and environmental conditions, yielding information not obtainable under field conditions. The optimum supply of mineral nutrients, as well as some aspects of their relative influence on growth have been determined.

Tobacco Diseases and Insects

In co-operation with the Botany and Plant Pathology Division, Science Service, special consideration has been given to black and brown root rots, mosaic and seedbed disorders. As a result of these investigations, diseases in tobacco seedbeds and greenhouses have been greatly reduced by soil sterilization and the use of fungicides. Sanitary measures have been evolved to reduce the spread of mosaic and other virus diseases in the seedbeds and in the field. Tobacco disease surveys and studies of crop rotations have revealed the importance of the effect of previous crops on the prevalence of black and brown root rots of tobacco. Control measures for insect pests are developed through co-operation with the Entomology Division.

Educational Work

Field days are held annually at the Experimental Stations in the chief tobacco-growing districts. These provide a means for the dissemination of practical information that results from experimental work, and are largely attended by growers. Fertilizer tests and variety demonstration plots are located on different soil types. Tobacco fertilizer recommendations, based on experimental findings, are prepared at an annual fertilizer conference and made available to growers and fertilizer companies.

Contact is maintained with tobacco growers by means of correspondence, special winter meetings, and personal interviews at the Experimental Stations and at the growers' farms. Timely bulletins, circulars, and press articles keep the tobacco producers informed on the most recent improved methods. Reports on progress of experiments are published by the Tobacco Division at Ottawa and by the various Stations.

ILLUSTRATION STATIONS

The Illustration Stations Division was established in 1915 to provide a connecting link between the Experimental Farms Service and farmers located in outlying districts. These Stations are operated on privately owned farms on the basis of a co-operative agreement entered into between the owner and the Experimental Farms Service. The need for the work originally was emphasized by the recurrence of crop failures caused by drought in the plains areas of Saskatchewan and Alberta. In 1916 Illustration Stations were established in Quebec; in 1920, Nova Scotia and New Brunswick; in 1921, British Columbia, and in 1923, Prince Edward Island, Ontario and Manitoba. By 1925 there were 223 Illustration Stations located throughout the nine provinces.

In 1935 a comprehensive farm planning and experimental program was developed which encompassed all farm operations. During that year drought and soil drifting had assumed major proportions in the Prairie Provinces and required a concerted and aggressive program of attack. The Illustration Stations in the plains areas of the West were reorganized, enlarged, and renamed as District Experiment Substations. Work in connection with strip farming and associated cultural practices, tree planting, water impounding practices, forage crop production, and cereal production was instituted. A similar reorganization of Illustration Station work was made in all other areas. On all Illustration Station units the whole farm is taken as the operating base and experimental work is conducted within the structure of a production unit. Experimental areas for detailed studies are located in each of the rotational fields and such investigations are conducted under conditions similar to those under which farmers generally are operating.

In 1937 a new type of unit, the District Experiment Substation with a resident agronomist-in-charge was established where experimental work on cereals, forage crops, fertilizers and horticultural crops is undertaken. Units of this latter type have been established at four locations on grey wooded soils in Saskatchewan and Alberta, on the reclaimed flats at Creston, B.C., at Fort William, Ontario, and in the Clay Belt of northern Quebec. In 1952 Illustration Stations were established at four locations in Newfoundland to supplement studies which are conducted on the Experimental Station at St. John's West in that province. The present organization comprises 178 Illustration Stations, and 48 District Experiment Substations of which 46 are in the Prairie Provinces. On 8 District Experiment Substations there are resident Agronomists-in-charge.

The work of the Illustration Stations Division has been consistently broadened in scope since 1915. It has progressed from its original purpose, of disseminating information by field and cultural demonstrations, to include precise experiments in the fields of soil fertility, crop adaptation, and cultural methods as well as studies of farm management and farm accounts. Farm problems are studied in their local environment, and this represents an extension of the comprehensive research work carried on at the Experimental Farms. In this way the results of such work are evaluated under specific conditions and are brought quickly to the communities concerned.

Variety test plots of cereals (left foreground) and peas (right foreground) on reclaimed Kootenay River flats, District Experiment Substation, Creston, B.C.

Specific Problems Studied

Soil, climate, and regional market conditions necessitate considerable variation in the nature of the work on different Illustration Stations. In Eastern Canada and British Columbia 26 types of rotations are under study and 41 in the Prairie Provinces. The purpose of these rotation studies is to determine what crops are adapted to particular regions and what sequences of crops are most satisfactory from the standpoints of the control of weeds and insects, soil erosion, and the maintenance of soil fertility. Each rotation experiment is conducted on several stations. Studies of inherent soil productivity, the effect of chemical fertilizers on field crops, the improvement of pastured lands, the role of trace elements such as boron in controlling deficiency disorders in turnips and other crops, are all

divisional activities. Specialized problems, such as grey wooded soils research in the northern prairie areas, and investigations with hops, cranberries, and blueberries in the Eastern Provinces, are also under study. Recently work dealing with irrigation practices has been developed in Saskatchewan, as well as farm-type irrigation projects in British Columbia. All investigations relative to soils and crops are correlated with soil survey information in order that the influence of soil differences can be determined.

Farm Organization and Management Studies

Farm organization and management studies are important projects of this Division and are carried on in conjunction with experimental work on Illustration Station properties. Each operator maintains a weekly record of cash revenue and expenditure for all farm enterprises and a complete inventory is taken at the end of each business year. This procedure permits evaluation of farm operations from the financial as well as the experimental standpoint. Other studies are conducted to determine the relative profitability of rotational practices. In these studies data relative to yield, cost and value are cross-referenced. Important features of farm management activities are the establishment of field divisions, and farm planning, as well as livestock improvement. The objective on an Illustration Station is not only to develop an improved herd but eventually to establish a source from which local farmers may procure breeding stock. During the year 1952 station operators disposed of 369 head of cattle, 100 sheep, 339 swine, 235 cockerels, 632 pullets, 9,088 baby chicks and 2,787 dozens of hatching eggs to farmers in their immediate districts.

Wheat Production Studies are Important

There are 99 Illustration Stations and District Experiment Substations located in the Prairie Provinces. Studies on wheat production have been a major activity on these stations since their establishment. Rotational experiments, tillage tests, fertilization and weed control, soil moisture studies and cost of production are some of the main phases of study under way on the wheat crop. The initial design of cropping experiments was chosen many years ago with considerable foresight and two of the original crop rotations are still being followed. These Illustration Station units afford a continuity of records in wheat production from the standpoint of yield and cost of production under the best known and adapted systems of cropping. The very important influence of moisture in wheat production is recognized, and a rain gauge is provided as standard equipment on Illustration Stations situated in areas where in some years

rainfall has been inadequate for normal growth and maturity of cereal crops. The penetration of moisture on areas under fallow, the measurement of moisture reserves at seeding time, and the correlation of these data with yield records, are important recent phases of investigation. Precipitation and yield data have been recorded through a number of years for many localities over a wide area of the wheat growing plains.

Illustration Station units serve as testing points for improved cereal varieties, in co-operation with the Cereal Crops Division, and the results from such investigations aid in determining the respective zones of adaptation for new selections as these are developed. In addition to this important work Illustration Station farms also serve as centres of production and distribution for recommended varieties. In 1952 Illustration Station operators disposed of 43,175 bushels of seed grain of approved varieties of which 34,562 bushels were distributed from stations in the three Prairie Provinces. Varieties such as Marquis, Reward, Garnet, Thatcher were increased on Illustration Stations. In 1946 Stations in the sawfly-infested areas of Alberta and Saskatchewan served as production and distribution points for seed of Rescue wheat and in 1953 these same stations have grown increase plots of the Chinook variety.

Forage Crop Production

Forage Crop investigations conducted on Illustration Station farms involve studies of species and mixtures, seed production and, as well, extensive work in the Eastern Provinces and British Columbia on pasture management. The great interest now taken in grassland agriculture has given rise to a need for detailed studies of the adaptation of forage crop species over a wide range of soil and climatic conditions. Projects dealing with this phase of forage crop investigations have been established on Illustration Station farms in all districts of supervision throughout Canada where grassland is of economic significance. Pioneer work in the growing of seed of legumes such as red clover, alsike, sweet clover, and alfalfa has been a feature of Illustration Stations work since 1917. Specific work has been done on the Cloverdale B.C. Illustration Station in 1952 and 1953 on the effect of the chemical I.P.C. on annual rye grass, interference from which is a serious problem with red clover seed producers in the Fraser Valley. The present work with this chemical has given quite promising results.

Coincident with the establishment of Illustration Stations in the northern areas of the Prairie Provinces, as well as in the Peace River district and British Columbia, research in the production of seed of other legume crops has made rapid progress.

Alfalfa seed production has been given considerable study in the northern prairies and the Peace River district. With the advent of war in 1939 it became apparent that there was a definite requirement for Canadian grown forage seeds. During the seven years, 1941-47 inclusive, operators of Illustration Stations grew and distributed by sale a total of 504,419 pounds of seed of legumes and grass plants. This provided an important nucleus for the expansion of seed and forage production at a time when it was urgently required.

Extensive investigations are conducted with fertility requirements and cultural practices as they relate to pasture production. A total of 611 annual records have been collected from a uniform experiment in the Eastern Provinces and British Columbia since 1944, planned to determine the value of nitrogen, phosphorus and potash in the maintenance of the fertility of pasture swards. Investigational work on methods of rejuvenation of old pastures has been established in the East on rough land areas where only minimum tillage is possible. On Stations at New Glasgow, Knoydart and Glenora Falls, in Nova Scotia, the average yield of untreated pasture was 3·22 tons of green herbage per acre in 1952. Where reseeding was done on the surface of the sod, production was increased to an average yield of 8·47 tons of green herbage per acre.

Horticultural Crops

The development of small home orchards is an important enterprise on the Illustration Stations and District Experiment Substations. This work was begun in Nova Scotia in 1930 but has since become important in all provinces. The provision of adequate protection by the use of shelterbelts has allowed for considerable expansion of this project throughout the Prairie Provinces also, and hardy adapted varieties of tree and bush fruits are now being grown successfully on Illustration Stations in these areas. More complex experimental work dealing with vegetables and small fruits is conducted on the District Experiment Substation at Creston, B.C., where varieties and strains are being tested as to their commercial possibilities. Useful information on the hardiness and adaptation of new varieties resulting from breeding work at Experimental Stations is derived from this project conducted on Illustration Stations, both from the standpoint of the home gardener and that of the commercial producer. This is particularly true in the Prairie Provinces. In the early years of settlement and development of the Prairies the production of horticultural crops was not considered as being a possibility.

View of experimental hop yard, Fournier Illustration Station in Eastern Ontario. Clean cultivation is important for both disease and insect control.

Improvement of Gardens and Home Surroundings

While Illustration Station experiments are primarily concerned with problems relating to crop production, the development and maintenance of attractive home surroundings is also an important activity. The objective on every Illustration Station is to develop a constructive program of planting shelterbelts, hedges, shrubbery, flower borders and lawns to illustrate what varieties are best suited to a locality and also the most effective arrangement of varieties and species. Since 1935 over

40,000 evergreens and 300,000 deciduous trees have been set out on Experiment Substations in the Prairie Provinces for the purpose of showing the feasibility and practicability of well planned farm shelterbelts.

The giving of advice on building plans for the erection of new barns and other buildings as required, improvements to existing buildings, installation of lighting and water systems and other special equipment necessary to the particular type of organization, is another phase of improvement projects which receives attention.

Field Days and Co-operative Efforts

Work on Illustration Stations and District Experiment Substations is planned to perform the dual function of strictly experimental work combined with a policy of immediate usefulness and service to the various communities in which they are located. It is essential that the crops grown, the methods adopted and the results from experimental work pertaining to local problems shall be brought to the attention of neighbouring farmers with a minimum of delay. Field days are held on these Illustration Station farms, and where possible they are organized in co-operation with the local agricultural society or representative. On these occasions details are discussed by officers of the Experimental Farms Service relative to the production of the different crops grown, selection of varieties, soil preparation, fertilizer treatment, and other matters. An analysis of field day records shows that these events are attended annually by from 20,000 to 25,000 farmers. They provide an effective means of bringing the results of investigational work conducted by the Experimental Farms Service to the attention of farmers in the districts served.

WEATHER RECORDS

Weather records and the use of weather data are an important part of the experimental program on the Experimental Farms. Canada's climate varies from cool, moist maritime conditions on the east and west coasts to a dry, continental type with cold winters and hot summers, in the interior. Because of this wide variation in climate, weather data are useful to the Canadian agriculturalist in many ways, a few of which are: in zoning for crop adaptation; in the planning and ventilation of buildings; in arranging pasture programs for livestock; and in interpreting the results of experiments with plants and animals.

Agricultural practices throughout Canada are closely related to differences in regional climate. The cool, moist climate of the eastern Maritime Provinces is excellent for the growth of forage crops and potatoes. The warmer climate of Quebec and Ontario with an annual precipitation of 30 to 35 inches is favorable for mixed farming. In some areas specialty crops such as fruit, tobacco, soybeans, and canning crops are grown. The drier climate of the Prairies, with an annual precipitation rang-

Agricultural Meteorology is an important field of research.

ing from 11 to 20 inches, is ideal for cereal crops, especially hard spring wheat. The climate of British Columbia is affected by extensive mountain ranges and proximity to the Pacific Ocean. The precipitation is generally high on the west slopes and low on the east slopes of the mountain ranges. Agricultural production also is variable but the fruit industry is noteworthy and flourishes in the dry, hot interior valleys where irrigation can be practised. In northwestern Canada long, cool days in summer help to provide conditions suitable for rapid growth of many cereal, forage and vegetable crops.

Evaporation is a valuable meteorological observation taken at most Experimental Farms. When compared with rainfall, evaporation gives an indication of the relative aridity of a region. For example, on the Prairies where the climate is normally dry, the average summer evaporation at Swift Current exceeds the average summer rainfall by about 19 inches. In the moister climate of Quebec, on the other hand, the average summer evaporation at L'Assomption exceeds the average summer rainfall by only 3 inches. Evaporation is measured daily by noting the drop in the water level in a 4-foot diameter tank sunk in the ground, but well exposed to wind and sunshine.

The following tables show, for Experimental Stations in various parts of Canada, long-term monthly and annual averages of temperature, precipitation and evaporation as well as average dates of some farm operations.

Table 1—Temperatures on Experimental Farms, Monthly and Annual Mean, Degrees F.

——	Yrs. Av.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
St. John's Nfld.	3	28·1	28·9	29·2	38·6	42·5	52·3	61·5	62·2	52·9	44·3	38·7	31·7	42·6
Charlottetown, P.E.I.	41	18·5	17·4	26·7	37·2	48·7	58·6	66·3	65·5	58·0	48·3	37·1	25·1	42·3
Kentville	35	20·6	20·1	29·2	39·4	50·5	59·3	66·4	65·1	57·9	48·1	37·4	25·4	43·3
Nappan, N.S.	38	17·6	17·0	27·1	37·8	48·9	58·0	64·6	63·6	56·4	46·6	35·8	22·9	41·4
Fredericton, N.B.	38	13·8	15·1	26·7	39·3	50·6	60·5	66·5	64·6	56·7	46·1	33·7	19·5	41·1
Ste. Anne, Que.	39	11·2	12·1	23·6	36·6	49·4	59·3	65·1	62·9	54·6	44·2	31·0	16·4	38·9
Lennoxville, Que.	36	12·9	13·4	25·1	38·5	51·9	61·6	66·6	64·4	56·3	45·3	32·9	18·1	40·6
Normandin, Que.	14	−1·0	3·3	14·8	31·7	47·7	58·2	63·5	61·3	52·0	41·3	26·6	8·0	33·9
L'Assomption, Que.	21	11·2	11·7	24·3	40·3	54·1	63·8	68·7	66·7	58·0	46·5	33·1	16·2	41·2
Ottawa, Ont.	63	11·9	12·8	25·0	41·4	54·8	64·6	68·9	66·4	58·4	46·4	32·7	17·5	41·7
Delhi, Ont.	16	23·0	23·1	32·4	43·2	55·3	65·5	70·2	68·8	60·8	50·5	37·9	26·9	46·5
Harrow, Ont.	33	25·5	27·3	35·4	45·7	57·7	68·3	72·9	70·7	64·1	53·0	40·1	29·1	49·2
Kapuskasing, Ont.	33	−1·3	2·5	14·4	31·3	45·9	57·4	62·6	60·4	51·4	40·1	22·9	6·9	32·9
Morden, Man.	32	3·4	6·9	20·1	38·0	52·6	62·4	69·0	66·5	56·7	43·7	27·7	9·7	38·1
Brandon, Man.	61	−1·5	2·0	17·2	38·0	50·7	59·9	65·4	62·5	52·8	40·5	21·5	6·6	34·6
Melita, Man.	16	1·6	3·8	17·6	39·0	51·9	59·4	66·8	64·6	54·6	43·4	23·0	9·3	36·2
Indian Head, Sask.	45	0·3	5·0	18·1	37·1	50·3	59·2	65·2	62·3	52·1	39·8	21·9	7·9	34·9
Regina, Sask.	18	0·0	2·7	17·8	38·0	51·6	58·0	67·0	63·0	52·0	41·0	21·0	8·0	35·0
Melfort, Sask.	13	2·4	1·2	14·8	35·0	50·7	53·8	63·8	62·5	53·3	41·2	20·0	8·6	33·9
Swift Current, Sask.	29	8·4	12·3	24·2	40·3	51·8	59·0	66·3	62·9	52·8	41·9	25·3	13·8	38·3
Scott, Sask.	39	−·4	3·4	16·4	37·2	49·9	57·5	60·3	59·4	50·4	38·8	20·1	6·4	33·3

Manyberries, Alta	22	10·4	12·1	25·3	42·3	52·7	59·8	68·6	65·9	54·8	43·9	27·3	16·7	40·0
Lethbridge, Alta	49	16·8	18·6	28·4	42·1	51·0	58·3	64·6	62·3	53·4	44·5	31·2	21·7	41·1
Lacombe, Alta	43	7·6	11·8	23·4	38·9	49·4	55·3	61·3	58·4	50·1	40·1	24·6	13·0	36·1
Ft. Vermilion, Alta	42	−10·5	−4·4	10·3	31·5	48·8	56·2	61·1	57·6	46·8	33·5	10·8	−5·3	28·0
Beaverlodge, Alta	35	8·9	12·5	22·4	37·4	49·3	55·8	60·0	57·8	49·8	39·5	23·8	11·9	35·8
Summerland, B.C.	35	25·0	29·3	39·2	48·2	56·5	63·5	70·1	68·2	59·8	48·5	36·6	29·1	47·8
Agassiz, B.C.	56	34·6	38·0	43·3	49·7	55·7	60·4	64·2	64·1	58·5	51·1	42·3	37·5	49·9
Saanichton, B.C.	37	36·2	38·3	42·8	47·4	53·7	58·7	62·4	62·0	56·7	49·9	43·0	39·2	49·2
Prince George, B.C.	36	13·2	18·7	29·1	40·4	49·7	56·2	59·6	58·1	50·3	41·0	28·6	17·7	38·6
Smithers, B.C.	13	15·6	20·3	30·1	39·5	48·5	53·5	57·1	55·6	50·3	39·2	28·0	18·1	38·0
*Kamloops, B.C.	49	22·0	27·0	38·0	50·0	58·0	64·0	70·0	68·0	58·0	48·0	36·0	27·0	47·0
*Ft. Simpson, N.W.T.	42	−18·0	−11·0	1·0	26·0	45·0	56·0	62·0	57·0	46·0	29·0	4·0	−12·0	24·0
Whitehorse, Y.T.	7	−2·3	−1·0	15·5	29·0	42·4	50·3	53·6	50·2	42·4	28·3	8·2	−6·0	25·9

* From Climatic Summaries, Vol. 1,
Meteorological Division,
Department of Transport.

Table 2—Precipitation on Experimental Farms, Mean Monthly and Annual, Inches

Station	Yrs. ave.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Snow-fall	Total Annual Precip.
St. John's, Nfld.,	3	6·18	7·00	6·58	8·36	4·29	2·63	1·89	4·81	3·98	5·85	7·48	7·61	113·3	66·66
Charlottetown, P.E.I.	41	3·99	3·40	3·41	2·93	2·91	2·98	2·98	3·29	4·06	4·23	4·02	4·53	109·4	42·73
Kentville, N.S.	35	3·97	3·28	3·16	2·77	2·86	3·01	2·95	3·19	3·54	4·09	4·06	4·04	78·4	40·92
Nappan, N.S.	38	3·29	2·92	2·77	2·77	2·65	2·89	2·69	3·30	3·56	3·71	3·93	3·71	77·7	38·19
Fredericton, N.B.	38	3·39	2·78	3·08	3·30	2·94	3·51	3·30	3·44	3·56	3·75	3·59	3·24	88·8	39·88
Ste. Anne, Que.	39	2·93	2·65	2·68	2·77	3·13	3·49	3·78	3·26	3·63	3·26	3·02	2·56	106·9	37·16
Lennoxville, Que.	36	3·23	2·55	3·02	2·90	3·04	3·99	4·17	3·53	3·67	3·58	3·46	3·06	95·2	40·20
Normandin, Que.	14	1·80	1·89	1·78	1·87	2·51	3·69	4·05	3·25	3·75	2·43	2·15	2·29	82·3	31·46
L'Assomption, Que.	21	3·09	2·46	2·86	3·10	2·97	3·46	3·66	3·28	3·59	2·87	3·28	3·06	84·7	37·68
Ottawa, Ont.	63	2·93	2·37	2·74	2·42	2·85	3·40	3·62	3·16	2·96	2·64	2·70	2·89	86·6	34·68
Delhi, Ont.	16	3·05	3·13	3·08	3·28	3·43	3·21	3·21	2·60	2·70	2·76	3·00	3·05	57·3	36·50
Harrow, Ont.	33	2·07	2·00	2·37	2·67	2·48	3·05	2·21	2·24	2·46	1·98	1·84	1·98	35·1	27·35
Kapuskasing, Ont.	33	1·89	1·32	1·68	1·74	2·20	2·62	3·20	3·12	3·23	2·13	2·36	2·05	92·4	27·54
Morden, Man.	32	0·95	0·91	1·37	1·37	2·20	3·10	2·81	2·14	2·10	1·38	1·19	0·98	55·5	20·50
Brandon, Man.	61	0·86	0·67	0·92	1·11	1·95	3·17	2·80	2·36	1·67	1·03	0·84	0·78	46·4	18·16
Melita, Man.	16	0·67	0·76	1·07	1·21	2·03	4·20	2·81	3·23	1·30	0·99	0·93	0·94	49·4	20·14
Indian Head, Sask.	54	0·78	0·70	1·04	0·88	1·89	3·45	2·27	2·00	1·66	1·11	0·94	0·78	50·8	17·50
Regina, Sask.	18	0·64	0·63	0·67	0·75	1·46	3·11	2·03	1·83	1·12	0·60	0·65	0·56	32·0	14·05
Melfort, Sask.	13	0·67	0·76	0·43	1·01	1·32	2·76	2·46	1·54	1·33	0·93	0·73	0·82	38·0	14·76
Swift Current, Sask.	29	0·66	0·47	0·55	0·82	1·55	2·81	1·91	1·74	1·09	0·72	0·55	0·52	30·2	13·39
Scott, Sask.	39	0·66	0·59	0·57	0·86	1·45	2·25	2·23	1·75	1·29	0·75	0·64	0·67	36·0	13·71

Manyberries, Alta.	22	0·59	0·46	0·73	0·90	1·25	2·36	1·34	0·76	1·01	0·70	0·58	0·55	34·9	11·23
Lethbridge, Alta.	49	0·66	0·73	0·92	1·11	2·33	2·80	1·69	1·49	1·68	0·99	0·80	0·70	51·3	15·90
Lacombe, Alta.	43	0·67	0·70	0·77	1·29	1·96	3·32	2·90	2·44	1·56	0·80	0·74	0·66	41·4	17·81
Fort Vermilion, Alta.	42	0·66	0·55	0·67	0·56	1·26	1·68	1·90	1·68	1·24	0·68	0·66	0·72	37·5	12·26
Beaverlodge, Alta.	35	1·31	1·02	1·11	0·84	1·55	1·98	2·35	1·87	1·73	1·10	1·29	1·22	69·2	17·37
Summerland, B.C.	35	0·90	0·75	0·67	0·76	0·91	1·24	0·86	0·78	0·80	0·92	0·99	0·98	32·1	10·56
Agassiz, B.C.	59	7·53	5·99	5·66	4·41	4·13	3·71	1·95	2·16	4·21	6·78	8·19	8·27	35·8	62·99
Saanichton, B.C.	37	4·56	3·59	2·71	1·57	1·12	1·11	0·70	0·80	1·37	3·02	4·13	5·67	13·8	30·35
Prince George, B.C.	35	1·94	1·45	1·30	0·93	1·47	2·13	2·06	2·21	2·06	2·21	2·11	2·10	100·3	21·97
Smithers, B.C.	13	1·71	1·08	0·89	0·88	1·54	1·66	1·89	1·18	1·32	1·84	1·93	1·97	57·3	17·89
*Kamloops, B.C.	47	1·04	0·74	0·38	0·40	0·88	1·29	0·99	1·07	0·82	0·68	0·86	1·05	30·9	10·20
*Ft. Simpson, N.W.T.	42	0·72	0·70	0·48	0·70	1·37	1·46	1·99	1·47	1·31	1·07	0·85	0·84	54·6	12·96
Whitehorse, Y.T.	7	0·66	0·37	0·29	0·51	0·54	1·14	1·23	0·91	1·47	1·38	1·24	0·79	47·4	10·53

* From Climatic Summaries, Vol. 1, Meteorological Division, Department of Transport.

Table 3—Dates of Farm Operations, and Selected Weather Characteristics on Experimental Farms

Station	Av. date of first Seeding Spring Grain	Av. Date of First Harvesting		Av. Pasture Period		Av. Frost-Free Periods			Temperature Extremes Recorded ° F.		Average Date of Fall Freeze-up
		Hay	Oats or Wheat	Dairy Cattle Put Out	Cattle Taken In	Last Frost in Spring	First Frost In Fall	Days Frost Free	High	Low	
St. John's, Nfld	May 7	July 8	Aug. 31	May 12	Oct. 15	—	—	—	89	−4	Dec. 7
Charlottetown, P.E.I.	May 13	July 9	Aug. 15	May 26	Oct. 18	May 14	Oct. 14	152	98	−23	Dec. 1
Kentville, N.S.	May 10	July 2	Aug. 19	May 15	Oct. 26	May 23	Sept. 29	128	100	−24	Nov. 27
Nappan, N.S.	May 17	July 14	Aug. 28	May 26	Oct. 7	May 28	Sept. 20	114	94	−35	Dec. 2
Fredericton, N.B.	May 11	July 6	Aug. 21	May 23	Oct. 7	May 19	Sept. 27	130	102	−38	Nov. 24
Ste. Anne, Que.	May 7	July 17	Aug. 23	May 17	Nov. 10	May 17	Sept. 27	132	95	−33	Nov. 21
Lennoxville, Que.	May 1	June 28	Aug. 17	May 25	Oct. 20	May 31	Sept. 7	98	99	−48	Nov. 19
Normandin, Que.	May 23	July 10	Sept. 9	June 5	Oct. 26	June 4	Sept. 14	101	94	−53	Oct. 30
L'Assomption, Que.	May 2	June 23	July 27	May 23	Oct. 21	May 17	Sept. 20	125	99	−46	Nov. 21
Ottawa, Ont.	Apr. 27	June 22	Aug. 3	May 20	Oct. 15	May 15	Sept. 25	132	102	−38	Nov. 24
Delhi, Ont.	Apr. 5	June 20	July 25	May 15*	Nov. 15	May 16	Sept. 30	136	105	−22	Dec. 2
Harrow, Ont.	Apr. 4	June 14	July 16	Apr. 29*	Nov. 13	May 7	Oct. 11	156	105	−20	Indefinite
Kapuskasing, Ont.	May 13	July 17	Sept. 4	June 5	Oct. 27	June 16	Sept. 3	78	101	−53	Nov. 9
Morden, Man.	Apr. 23	June 26	Aug. 6	May 16	Nov. 2	May 18	Sept. 20	124	111	−40	Nov. 7
Brandon, Man.	Apr. 24	June 27	Aug. 3	May 17	Nov. 7	June 2	Sept. 5	94	110	−51	Nov. 9
Melita, Man.	Apr. 28	July 5	Aug. 9	May 10*	Nov. 3	May 31	Sept. 13	104	103	−49	Nov. 14

Indian Head, Sask.	Apr. 22	July 4	Aug. 13	May 25*	Nov. 15	June 1	Sept. 10	100	109	−50	Nov. 4
Regina, Sask.	Apr. 22	—	Aug. 9	—	—	June 11	Sept. 15	95	111	−52	Nov. 3
Melfort, Sask.	May 2	July 1	Aug. 16	May 10*	Nov. 2	June 6	Sept. 23	108	106	−53	Nov. 17
Swift Current, Sask.	Apr. 24	June 18	Aug. 12	May 25*	Nov. 15	May 25	Sept. 11	108	103	−55	Nov. 12
Scott, Sask.	Apr. 29	July 9	Aug. 15	May 11*	Oct. 24	June 3	Sept. 1	89	103	−59	Nov. 3
Manyberries, Alta.	Apr. 22	June 15	Aug. 15	Apr. 18*	Nov. 15	May 19	Sept. 16	119	105	−45	Nov. 11
Lethbridge, Alta.	Apr. 21	June 22	Aug. 8	May 24	Nov. 20	May 21	Sept. 14	115	102	−45	Nov. 26
Lacombe, Alta.	May 2	July 10	Aug. 26	May 1*	Oct. 15	June 8	Aug. 27	79	101	−57	Oct. 25
Ft. Vermilion, Alta.	May 11	July 16	Aug. 19	May 6*	Oct. 20	June 10	Aug. 24	74	100	−78	Oct. 23
Beaverlodge, Alta.	Apr. 27	July 9	Aug. 25	May 20*	Sept. 7	May 31	Sept. 6	97	98	−53	Nov. 6
Summerland, B.C.	—	May 28	—	May 1	Oct. 15	Apr. 25	Oct. 26	183	104	−14	Nov. 21
Agassiz, B.C.	Apr. 11	June 5	Aug. 3	Apr. 1	Oct. 31	Apr. 7	Nov. 2	208	103	−5	Indefinite
Saanichton, B.C.	Apr. 12	June 22	Aug. 7	Apr. 1	Oct. 31	Mar. 27	Nov. 14	231	94	9	Indefinite
Prince George, B.C.	May 8	June 30	Aug. 28	May 20	Sept. 15	June 17	Aug. 24	67	102	−58	Nov. 1
Smithers, B.C.	May 6	July 1	Aug. 20	May 7*	Nov. 2	June 16	Aug. 14	58	99	−48	Nov. 2
Ft. Simpson, N.W.T.	May 23	July 9	Aug. 24	June 3*	Oct. 4	June 5	Aug. 28	83	92	−69	Oct. 21
Whitehorse, Y.T.	May 1	July 10	Aug. 22	June 5*	Oct. 5	June 10	Aug. 29	79	88	−65	Oct. 20

*Average dates Beef Cattle put out on pasture and taken in.

Table 4—Evaporation in Inches From Free Water Surface, Monthly and Seasonal* Averages

—	Length of Record	May	June	July	Aug.	Sept.	Five months total
	Years	In.	In.	In.	In.	In.	In.
Charlottetown	8	3·38	3·56	4·85	4·00	3·76	19·55
Fredericton	8	2·90	3·76	4·71	3·75	2·83	17·95
Ste. Anne de la Pocatiere	8	2·87	3·87	4·74	3·82	2·69	17·99
Normandin	7	2·87	3·36	3·78	3·31	2·26	15·58
Lennoxville	8	3·07	3·96	4·51	4·82	3·05	19·41
L'Assomption	8	3·38	4·28	4·84	4·10	3·24	19·84
Ottawa	27	3·22	4·10	4·83	4·38	2·77	19·30
Delhi	8	3·61	4·50	5·77	5·14	3·36	22·38
Kapuskasing	8	—	2·70	3·21	2·78	1·49	—
Morden	13	4·44	6·02	5·53	4·74	3·65	24·38
Brandon	15	—	4·10	4·13	4·15	2·89	—
Indian Head	25	3·77	3·89	4·97	4·75	2·89	20·27
Scott	30	4·25	3·71	4·58	3·76	2·45	18·75
Swift Current	31	5·48	5·73	7·31	6·29	4·08	28·89
Manyberries	25	5·33	6·26	7·79	6·87	4·70	30·95
Lethbridge	30	4·52	4·63	6·01	4·94	3·33	23·43
Lacombe	25	3·13	3·10	3·79	3·14	1·88	15·04
Beaverlodge	31	3·45	3·68	4·19	3·34	2·00	16·66
Fort Vermilion	7	3·40	2·81	3·57	3·15	1·99	14·92

Summerland	24	4·85	4·78	5·87	4·77	3·00	23·27
Agassiz	6	2·13	2·53	3·23	2·83	1·85	12·57
Saanichton	5	3·74	4·77	5·01	3·97	2·84	20·33
Prince George	7	2·79	2·63	2·12	2·25	1·35	11·14
Whitehorse	7	3·42	4·70	4·01	3·07	1·70	16·90

* Total for the 5 months, May to September, incl.

EXPERIMENTAL FARMS SERVICE

Director, E. S. Hopkins, B.S.A., M.Sc., Ph.D.

Central Experimental Farm, Ottawa, Ontario.

Division	*Chief*
Animal Husbandry	K. Rasmussen, B.S.A., M.Sc., Ph.D.
Apiculture	C. A. Jamieson, B.S.A., Ph.D.
Cereal Crops	C. H. Goulden, B.S.A., M.Sc., Ph.D.
Field Husbandry, Soils & Agricultural Engineering	P. O. Ripley, B.S.A., M.Sc., Ph.D.
Forage Crops	T. M. Stevenson, B.S.A., M.Sc., Ph.D.
Horticulture	M. B. Davis, B.S.A., M.Sc.
Illustration Stations	A. E. Barrett, B.S.A., M.Sc.
Poultry	H. S. Gutteridge, B.S.A., M.Sc.
Tobacco	N. A. MacRae, B.A., M.Sc., Ph.D.

Newfoundland

I. J. Green, B.S.A., Superintendent, Experimental Station, St. John's West.

Prince Edward Island

R. C. Parent, B.S.A., M.Sc., Superintendent, Experimental Station, Charlottetown.

C. K. Gunn, B.Sc., M.Sc., Ph.D., Superintendent, Experimental Fur Ranch, Summerside.

Nova Scotia

S. B. Williams, B.S.A., M.Sc., Superintendent, Experimental Farm, Nappan.

C. J. Bishop, B.Sc., A.M., Ph.D., Superintendent, Experimental Station, Kentville.

New Brunswick

S. A. Hilton, B.S.A., M.S.A., Superintendent, Experimental Station, Fredericton.

Experimental Substation, McDonald's Corner (Fruits and Vegetables).

Experimental Substation, Tower Hill (Blueberries).

Experimental Substation, Alma (Potato Breeding).

The above 3 substations are administered by the Experimental Station, Fredericton.

Quebec

E. Mercier, B.Sc., Ph.D., Superintendent, Experimental Station, Lennoxville.

J. R. Pelletier, B.S.A., M.A., M.Sc., Superintendent, Experimental Station, Ste. Anne de la Pocatiere.

R. Bordeleau, B.S.A., Superintendent, Experimental Station, L'Assomption.

A. Belzile, B.S.A., Superintendent, Experimental Station, Normandin.

L. J. Bellefleur, B.S.A., Superintendent, Experimental Substation, Caplan.

Experimental Substation, Ste. Clothilde (Organic Soils) administered by the Horticulture Division, Ottawa.

Ontario

Central Experimental Farm, Ottawa.

F. X. Gosselin, B.S.A., Superintendent, Experimental Station, Kapuskasing.

H. F. Murwin, B.S.A., Superintendent, Experimental Station, Harrow.

L. S. Vickery, B.S.A., M.Sc., Officer-in-Charge, Experimental Substation, (Flue-cured Tobacco) Delhi.

J. W. Aylesworth, B.S.A., M.S., Officer-in-Charge, Experimental Substation, (Soil Rehabilitation) Woodslee.

Both these Substations are administered by the Experimental Station, Harrow.

Experimental Substation, Smithfield, (Fruits and Canning Crops) administered by the Horticulture Division, Ottawa.

Manitoba

R. M. Hopper, B.S.A., M.Sc., Superintendent, Experimental Farm, Brandon.

Soil Reclamation Station, Melita, administered by the Experimental Farm, Brandon.

W. R. Leslie, B.S.A., Ll.D., Superintendent, Experimental Station, Morden.

E. M. MacKey, B.S.A., Officer-in-Charge, Pilot Flax Mill, Portage la Prairie.

R. F. Peterson, B.S.A., M.Sc., Ph.D., Officer-in-Charge, Laboratory of Cereal Breeding, Winnipeg.

Saskatchewan

J. R. Foster, B.S.A., Superintendent, Experimental Farm, Indian Head.

G. N. Denike, B.S.A., Superintendent, Experimental Station, Swift Current.

G. D. Matthews, B.S.A., Superintendent, Experimental Station, Scott.

H. E. Wilson, B.S.A., Superintendent, Experimental Station, Melfort.

H. W. Leggett, B.S.A., B.Sc., Superintendent, Experimental Substation, Regina.

John Walker, B.Sc., M.S., Superintendent, Forest Nursery Station, Indian Head.

W. L. Kerr, B.S.A., M.Sc., Superintendent, Forest Nursery Station, Sutherland.

W. J. White, B.S.A., M.Sc., Ph.D., Officer-in-Charge, Laboratory of Forage Crops, Saskatoon.

J. L. Doughty, B.S.A., M.Sc., Ph.D., Officer-in-Charge, Soil Research Laboratory, Swift Current.

Alberta

G. E. DeLong, B.S.A., M.Sc., Superintendent, Experimental Station, Lacombe.

H. Chester, B.S.A., Superintendent, Experimental Station, Lethbridge.

W. L. Jacobson, B.S.A., Experimental Substation, Vauxhall (Irrigation Studies).

Experimental Substation, Staveley (Foothill Rangeland Improvement). Both these Substations are administered by the Experimental Station, Lethbridge.

E. C. Stacey, B.A., M.Sc., Superintendent, Experimental Station, Beaverlodge.

H. F. Peters, B.Sc., M.S., Superintendent, Range Experiment Station, Manyberries.

V. J. Lowe, Officer-in-Charge, Experimental Substation, Fort Vermilion.

British Columbia

M. F. Clarke, B.S.A., M.S.A., Ph.D., Superintendent, Experimental Farm, Agassiz.
Experimental Substation, Boundary Bay (Potato Production) administered by the Experimental Farm, Agassiz.

T. H. Anstey, B.S.A., M.Sc., Ph.D., Superintendent, Experimental Station, Summerland.
Experimental Substation, Kelowna (Fruit Growing Under Irrigation) administered by the Experimental Station, Summerland.

F. V. Hutton, B.S.A., Superintendent, Experimental Station, Prince George.

J. J. Woods, B.S.A., M.S.A., Superintendent, Experimental Station, Saanichton.

W. T. Burns, B.S.A., M.Sc., Superintendent, Experimental Substation, Smithers.

T. G. Willis, B.S.A., M.S.A., Superintendent, Range Experiment Station, Kamloops.

Yukon and Northwest Territories

J. W. Abbott, Officer-in-Charge, Experimental Substation, Whitehorse.

J. A. Gilbey, B.S.A., M.Sc., Officer-in-Charge, Experimental Substation, Fort Simpson.

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1954